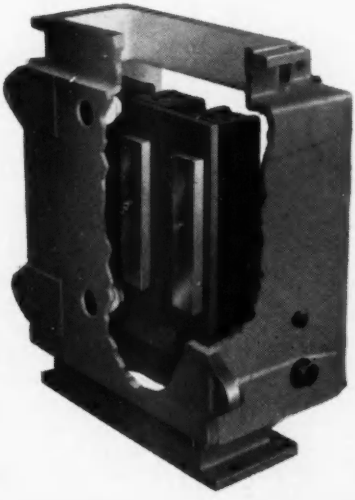
ELECTRICAL TIMES
THURSDAY
10 MAY
1951
SIXPENCE

ENGLISH ELECTRIC'

fusegear

Fully-Shrouded Contacts now STANDARD on C.F.S.

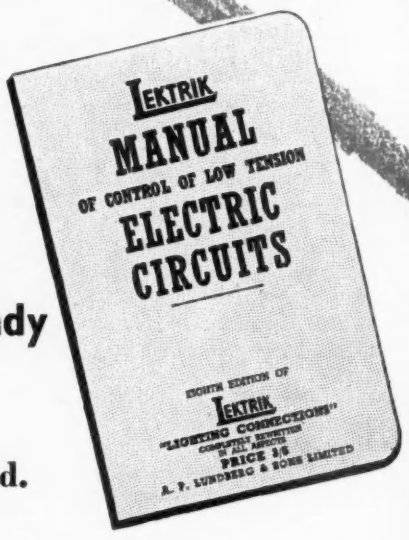
Since introduction of the full-shrouding feature, demand has been so great as to justify standardisation. Permitting high manual breaking capacity it increases operator-safety and eliminates flashovers.



The ENGLISH ELECTRIC Company Limited

Queens House, Kingsway, London, W.C.2 · Fusegear Works: East Lancashire Road, Liverpool 10

Works: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL



a book you simply must keep handy

134 pages
83 diagrams
20 plates

3/6d.

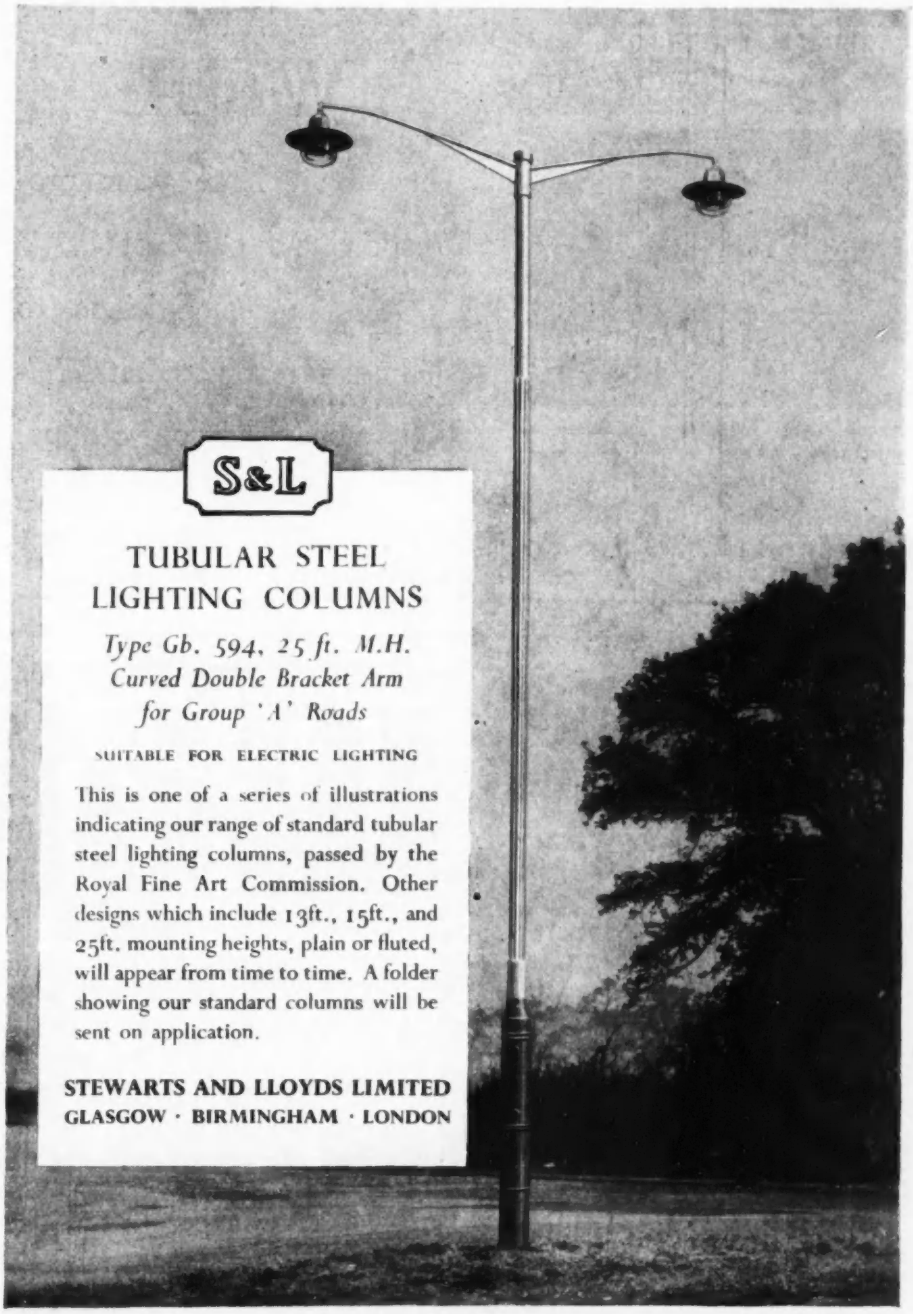
Good news about a famous and extremely practical publication—the 4¼″ wide, 6¾″ long pocket-size 'LEKTRIK' handbook that's packed with essential information for the working electrician. All the latest advances in electrical practice have been taken into consideration in this completely rewritten eighth edition of The 'Lektrik' Manual of Control of Low-Tension Electric Circuits. The fully comprehensive seven-page index covers an incredibly wide range of subjects. It's the most modern Manual on the market. Post your order NOW with your remittance (postage 3d. on single copies) to Simplex Electric Company Limited, Oldbury, Birmingham

Lundberg accessories

MADE BY THE HOUSE OF **Simplex**

Simplex Electric Co Ltd Oldbury Birmingham & Branches

A TI COMPANY



S&L

TUBULAR STEEL LIGHTING COLUMNS

Type Gb. 594, 25 ft. M.H.
Curved Double Bracket Arm
for Group 'A' Roads

SUITABLE FOR ELECTRIC LIGHTING

This is one of a series of illustrations indicating our range of standard tubular steel lighting columns, passed by the Royal Fine Art Commission. Other designs which include 13ft., 15ft., and 25ft. mounting heights, plain or fluted, will appear from time to time. A folder showing our standard columns will be sent on application.

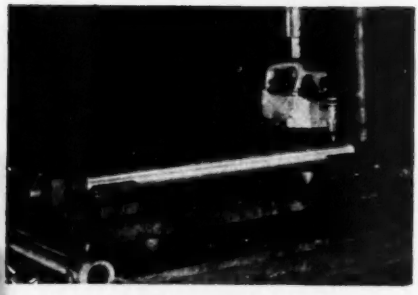
STEWARTS AND LLOYDS LIMITED
GLASGOW · BIRMINGHAM · LONDON

CYC-ARC
REG. TRADE MARK

STUD-WELDING WILL

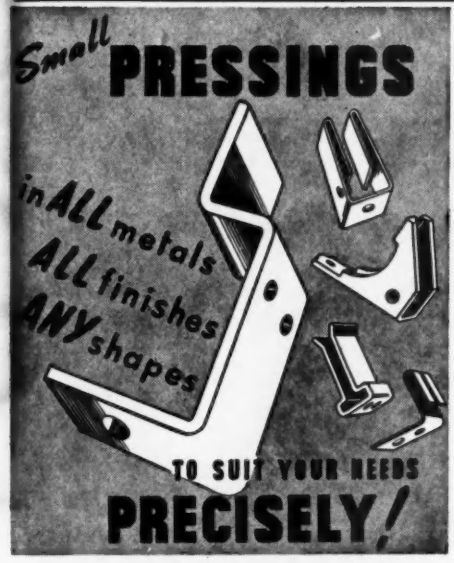
help to increase your production and cut cost!

Ask our technicians to demonstrate to you that CYC-ARC will speed your output!



CYC-ARC stud-welding mudguard stay bolts to motor-cycle front fork tubes in the works of Messrs. B.S.A. Co. Ltd.

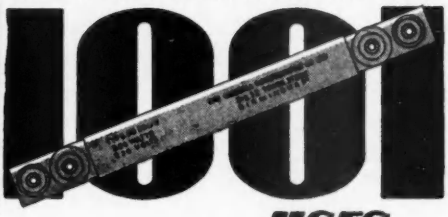
CYC-ARC Ltd., 27-29 NEW NORTH ROAD, LONDON, N.1
CLErkenwell 3344-8



GEORGE WILDEN
Western Works, 170, Pitsford St.,
Birmingham, 18. (*NOR* 2714)

1440

THE STEEL COVERED HEATER WITH

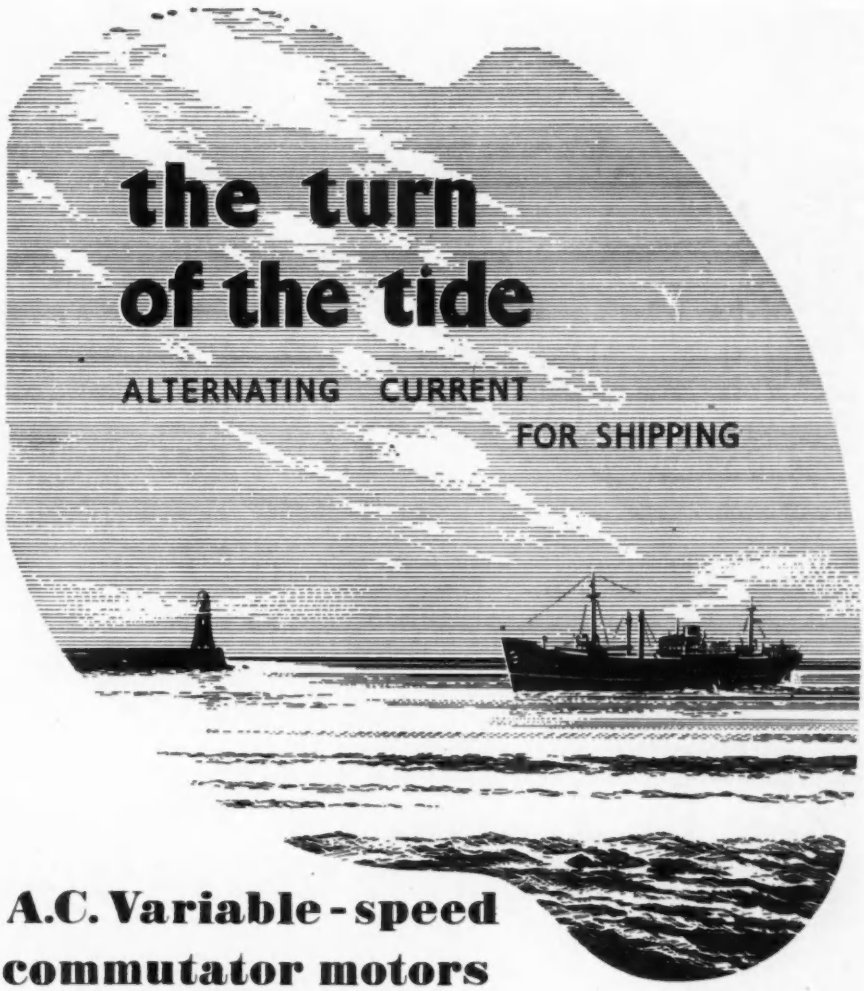


USES

IN its variety of forms, the Cressall steel jacketed unit heater is the solution to most heating problems. Let a Cressall Technical Expert discuss heating with you before you decide. He will be happy to help.

CRESSALL

Registered Trade Name of
THE CRESSALL MANUFACTURING CO., LTD.
Tower Street, Birmingham 19
Telephone: ASTon Cross 2666 (3 lines).
Telegrams: "OHMIC, Birmingham"



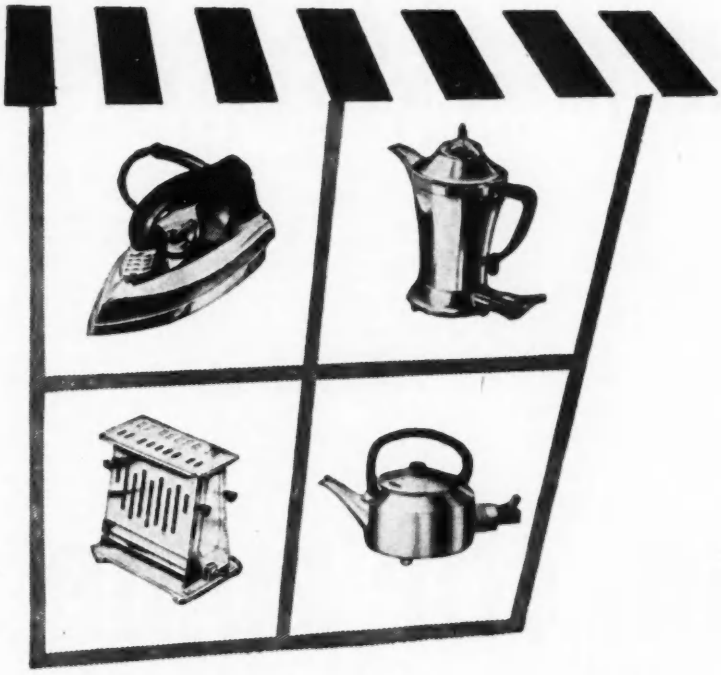
A.C. Variable-speed commutator motors for WINCHES

IDEAL SPEED/LOAD CHARACTERISTICS · FIXED BRUSH-GEAR · NO EXTERNAL REGULATOR

REYROLLE

HEBBURN Co. DURHAM ENGLAND

Destination...
SYDNEY
SCOTTISH CABLES
SUPER TENSION
33000 VOLTS
SCOTTISH CABLES LIMITED
DEANSIDE • RENFREW • SCOTLAND
LONDON OFFICE: MANFIELD HOUSE 376/379 STRAND W.C.2
Associated Company: SCOTTISH CABLES (SOUTH AFRICA) LTD. PIETERMARITZBURG, NATAL



Part of a Fine-Quality range of Appliances

Maximum quality together with low maintenance costs, combine to make the name of Premier Fine-Quality outstanding in the world of electrical heating appliances. This is the chief reason why Premier electric appliances are in constant demand.

PREMIER *FINE-QUALITY APPLIANCES*

PREMIER ELECTRIC HEATERS LTD · BIRMINGHAM 9

MEMBER OF THE A.E.I. GROUP OF COMPANIES

4079E

If you have
WATER IN THE *WRONG* PLACE –

Move it with a
WARSOP PUMP

PETROL DRIVEN ... 1½" —2"—3"
DIESEL DRIVEN ... 3"—4"

High Volume Capacity Self Priming Pumps — they are well suited to handling seepage containing up to 25% solids in the draining of foundations, pipe trenches, manholes, sumps, etc.

MADE TO THE SAME HIGH STANDARD AS THE FAMOUS
WARSOP BREAKER & ROCK DRILL

Ask for particulars from :— Dept. WA1/K/4

WARSOP *POWER* TOOLS LTD.
27, REGENT STREET, LONDON, S.W.1.
Telephone: Regent 4632 Telegrams: Warpetdril Piccy. London.

Sales & Service Depots:-
PECKHAM, S.E.15 · TAUNTON · NEWPORT · BEDFORD · BURTON-ON-TRENT
STOCKPORT · LEEDS · GLASGOW · BELFAST · DUBLIN

METROVICK *at the Festival...*

... presenting Electrical Engineering at its best

The main exhibits are :

LONDON — South Bank Exhibition *

Hall of Power
¼th full scale model 60-MW turbo-generator set.

Transport Section (Marine)
Demonstration of "Seascan" Radar.

"The Sea"
Marine Gas Turbine (M.T.B. 5559), originally installed in gunboat No. 2009.

Transport Section (Rail)
10 mm. to 1 ft. fine scale models of the British Railways (Western Region) experimental gas-turbo-electric locomotive and typical electric freight locomotive for metre gauge.
Metropolitan-Vickers—GRS Ltd. will exhibit railway signalling equipment.

Hungerford Bridge Site
An actual electric locomotive, one of 65 ordered for the Manchester—Sheffield Line (Eastern Region) on loan from British Railways.

Dome of Discovery (Physics Section)
EM3 Electron Microscope.
Electroflux Magnetic Crack Detector. This will be wired for special demonstrations.
Display showing operation of Mass Spectrometer.

LONDON — Science Museum (South Kensington)
EM3 Electron Microscope, with typical microphotographs.

GLASGOW — Kelvin Hall Exhibition
250 hp. motor which can be started and reversed by visitors.
Tesla Machine (Hall of Future). This will provide a vivid "lightning" effect required for the dramatic display of natural power.
10 mm. to 1 ft. fine scale model gas-turbo-electric locomotive.
Automatic Metallic Arc-Welding machine with electronic control of arc.
Rotor for low-pressure cylinder of typical 52·5 M W steam turbine.
Metropolitan-Vickers—GRS Ltd. will exhibit railway signalling equipment.

BELFAST
"Seascan" Marine Radar ; a working demonstration with the aerial scanning the surrounding district.

LAND TRAVELLING EXHIBITION
Manchester, Leeds, Birmingham, Nottingham
Model of gas-turbo-electric locomotive, scale ½" to 1 ft. (sectioned).
Axial compressor from the "Beryl" jet engine—the rotor will be turning and the stator is part-sectioned.

* *Examples of modern street lighting and industrial fittings also on show.*

METROPOLITAN-VICKERS ELECTRICAL COMPANY LIMITED
Trafford Park, Manchester 17. *Member of the A.E.I. group of companies*

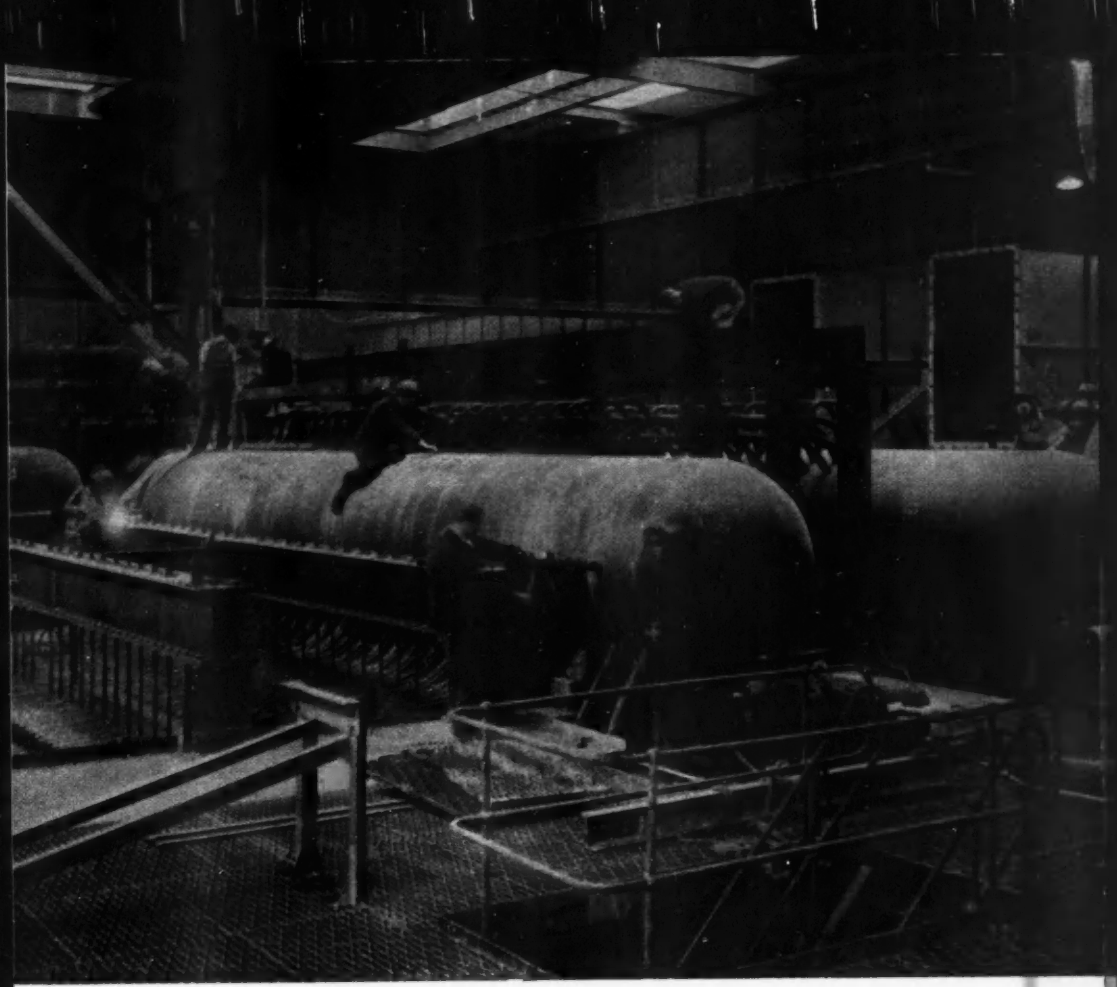
A/A109

TRADE +
HIGGS MOTORS
CHAIRMAN WALTER F. HIGGS, M.I.E.E. LTD.
BIRMINGHAM 6 MARK ENGLAND
−

The finest polishing motor in the world

GUARANTEED FOR EVER

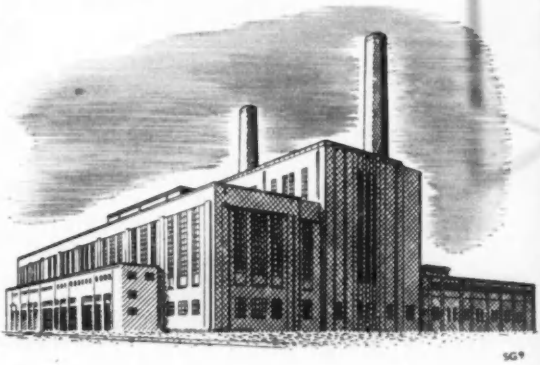
Belfast, Birmingham, Bristol, Cardiff, Dundee, Glasgow, Leeds, London, Manchester, Newcastle, Peterborough, Sheffield, Wolverhampton



Power in the making
—at Poole

The latest ICL-equipped station to go into action is at Poole, Dorset. In its final form this station will have eight 'International' pulverised fuel boilers each producing 300,000 lbs. per hour at 950 psi and 940° F. Complete coal-handling plant was also supplied by ICL.

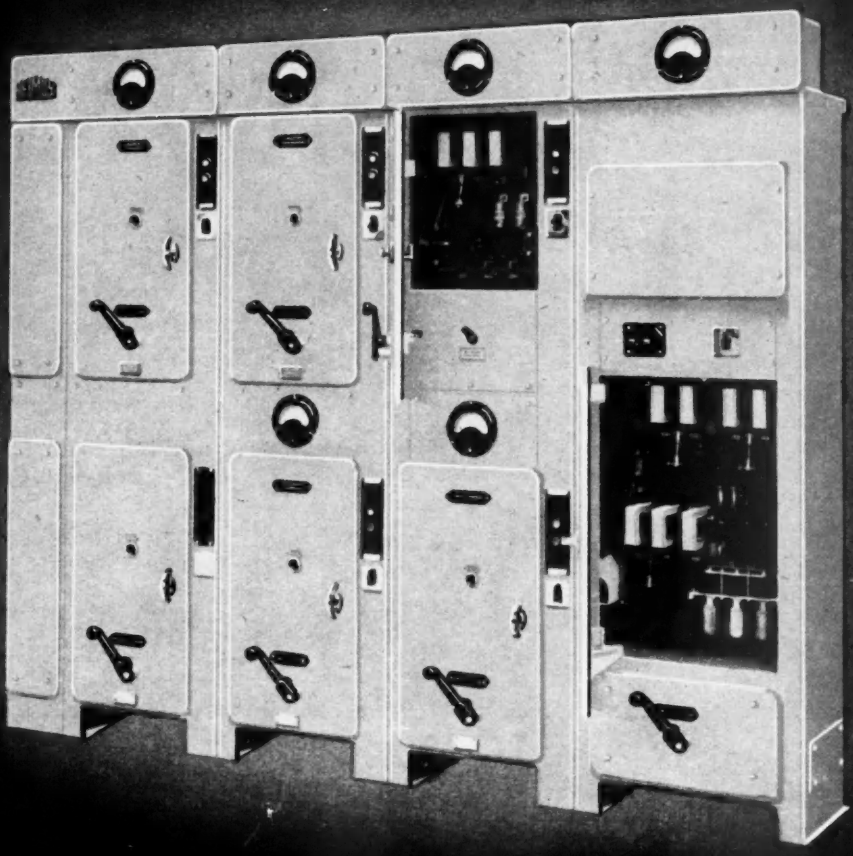
As more ICL boilers and ICL-equipped stations go into action, they are making a progressively more valuable contribution to the nation's power resources.



INTERNATIONAL COMBUSTION LIMITED

London Office: *Nineteen Woburn Place, WC1* Works: *Derby, England; Port Elizabeth, South Africa; Sydney, Australia*

motor control gear



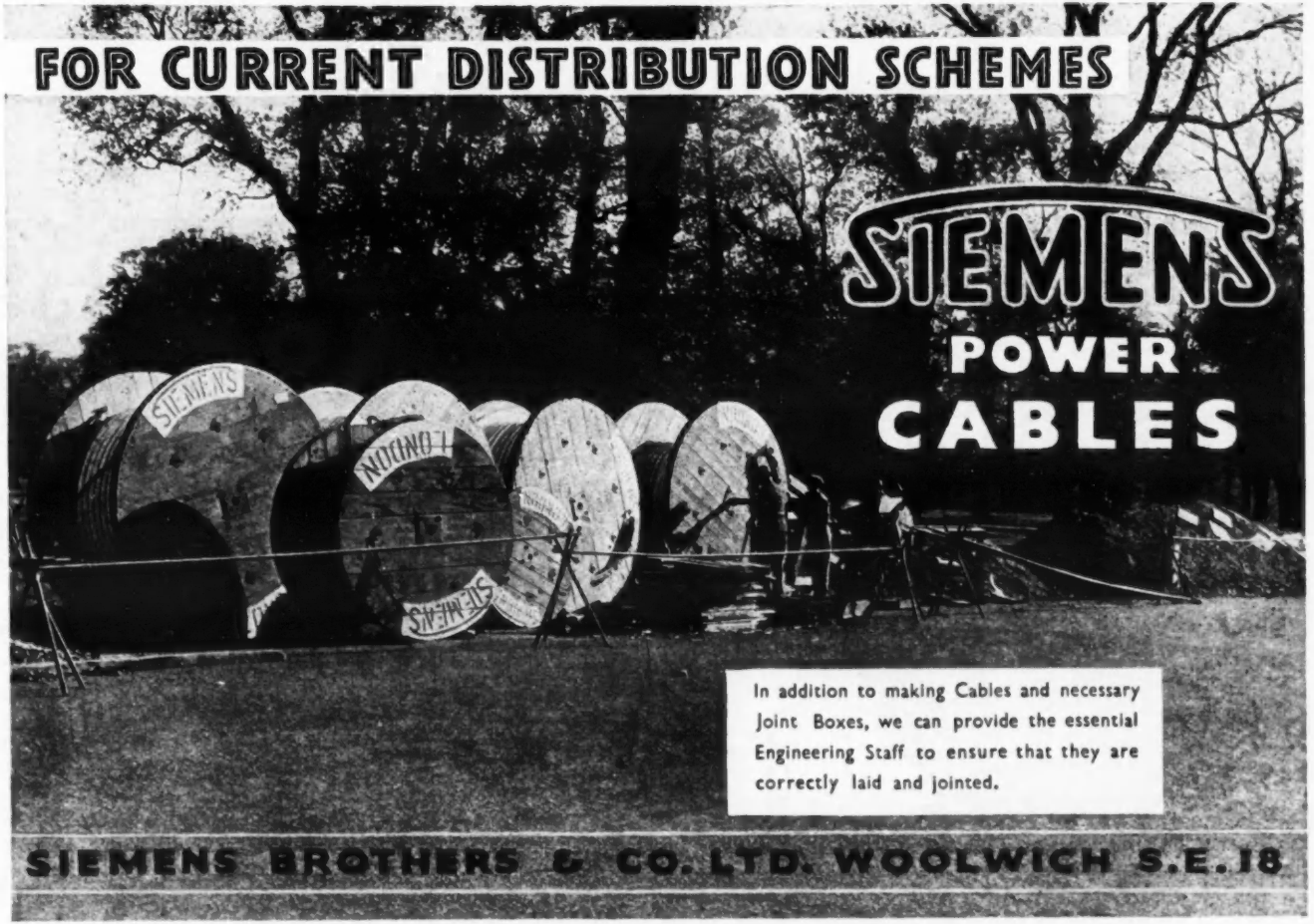
BELMOS

UP TO 660 VOLTS.
IN CUBICLE
PILLAR
OR WALL MOUNTING PATTERNS

the Belmos company limited

BELLSHILL · LANARKSHIRE

LONDON OFFICE: COLUMBIA HOUSE, ALDWYCH, W.C.2


FOR CURRENT DISTRIBUTION SCHEMES
SIEMENS
POWER
CABLES
SIEMENS
LONDON
SIEMENS
In addition to making Cables and necessary Joint Boxes, we can provide the essential Engineering Staff to ensure that they are correctly laid and jointed.
SIEMENS BROTHERS & CO. LTD. WOOLWICH S.E.18

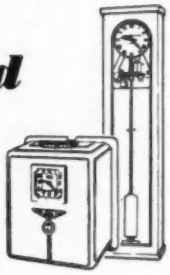
SMITHS

famous for all time . . .

the name behind the finest

MASTER CLOCKS and

TIME RECORDERS



Installations may be purchased outright or arranged on rental terms. Write to us for full details, or call at our showrooms for a practical demonstration.

ENGLISH CLOCK SYSTEMS LTD.

Speedometer House, 179-185 Great Portland Street, London, W.1 *Langham 7226.*
153-155 Bothwell Street, Glasgow, C.2 *Central 3972.*

THE INDUSTRIAL BRANCH OF SMITHS ENGLISH CLOCKS LTD.

CLEARIT—

IN SHORT SUPPLY ★

'EVOLITE'

PERSPEX TUBES & CYLINDERS

★ *Except Against Government Contracts*

This is a position which will be corrected as soon as supplies permit.
In the meantime we INVITE ENQUIRIES FOR MACHINING OF PERSPEX and other materials.

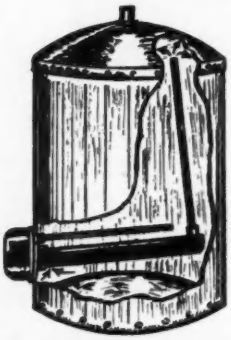
RICHARD DALEMAN LTD.

325/327 Latimer Road · London, W.10

Engineers in Perspex

"Dunlow"

ELECTRIC IMMERSION HEATERS and CIRCULATORS



Side Fixing Type Circulator with Mechanical Flange

2, 3 & 4 *kw.*

The Easiest Heater to fit

ALSO TOP ENTRY TYPE MADE IN VARIOUS LENGTHS

DUNCAN LOW LTD

291 BELL STREET, GLASGOW, C.4

'Phone: Bell 1961-2 *'Grams:* "Immerser, Glasgow"

TEMCO

ELECTRICAL ACCESSORIES

The following catalogue prices take effect on the 16th April, 1951, but orders can only be accepted at prices current at date of despatch.

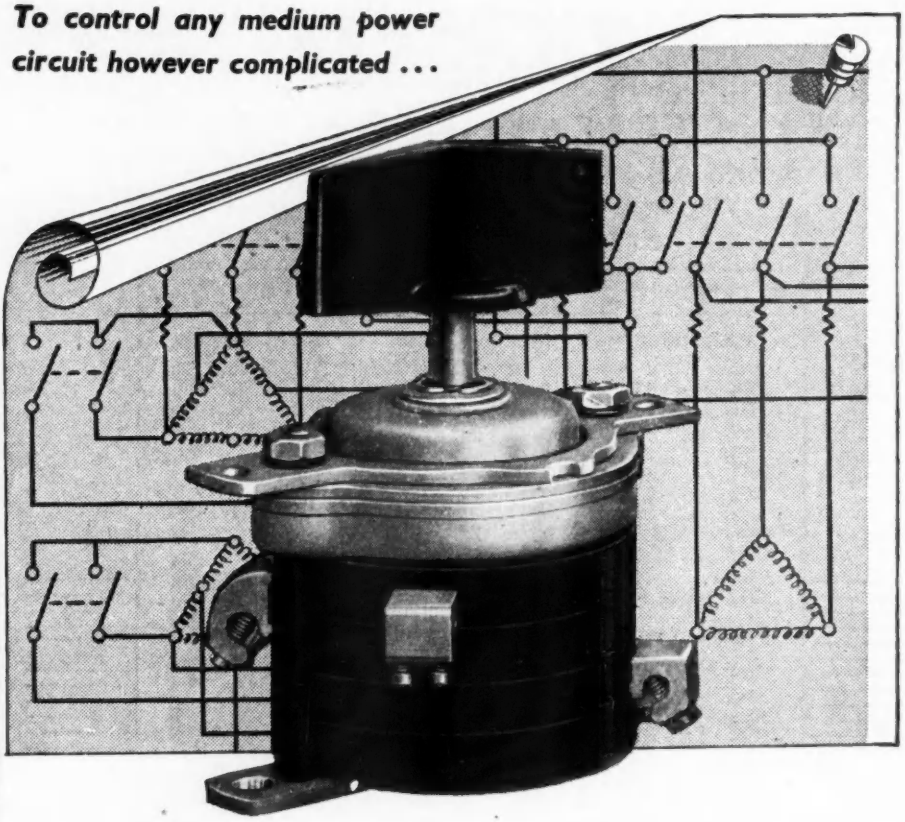
CAT. No.	PRICE per doz.
PAGE SIX	
5000	26/4
5001	39/4
5006	27/–
5007	40/–
5010	31/4
5011	44/4
5002	26/4
5003	39/4
5008	27/–
5009	40/–
5012	31/4
5013	44/4
PAGE SEVEN	
5044	25/8
5045	38/8
5046	29/4
5047	42/4
5124	10/8
5114	17/–
5116	17/–
5118	32/4
5120	32/4
5122	42/4
5125	15/–
5115	24/4
5117	24/4
5119	44/4
5121	44/4
5123	58/4
PAGE EIGHT	
0100	64/8
0101	66/8
0102	79/4
0110	114/4
0111	117/8
0112	135/8
PAGE NINE	
0105	94/4
0106	97/4
0107	122/4
0115	141/4
0116	146/8
0117	166/–
PAGE TEN	
5018	88/–
5019	114/4
5502	136/4
5508	167/–
7001	202/4
7002	242/–
5500	145/–
5506	175/8
7011	215/4
7012	255/–
7031	162/8
7032	180/4
PAGE ELEVEN	
5042	105/4
5043	136/4
5503	158/4
5509	206/8
7006	215/4
7007	286/–
5501	167/–
5507	215/4
7016	228/4
7017	299/–
1053	30/8
1054	35/–
1056	48/4
1057	23/–
1058	25/–
1059	37/4
1060	15/4 doz. prs.
1061	17/4 doz. prs.
1062	24/– doz. prs.
PAGE TWELVE	
5024	17/8
5025	26/4
5028	19/8
0121	30/8
5029	29/4
0122	43/–
5026	27/4
5030	35/4
0123	47/–
5027	39/–
5031	48/4
0124	63/–
PAGE THIRTEEN	
8000	70/8
8001	83/8
8006	71/4
8007	84/4
8010	75/8
8011	88/8
Cords	12/–
PAGE FOURTEEN	
651	3/4 each
653	7/– each
PAGE FIFTEEN	
1700	22/–

T. M. C. - HARWELL (SALES) LTD.

37 UPPER BERKELEY STREET, LONDON, W.1

Telephone: PADdington 1867/9

To control any medium power circuit however complicated . . .



. . . there is a ready-made type of

SANTON ROTARY SWITCH!

SANTON switches operate on a simple rotary movement.

SANTON switches have large, easily accessible terminals, plainly marked.

SANTON switches are available from 10-60 Amps. (180 under special conditions), any number of poles up to six positions—up to 660 volts.

SANTON switches can be delivered promptly and give years of trouble-free service.

Most areas have a SANTON Resident Engineer who will be pleased to call and discuss your switching problems with you. Take the first step today towards simpler, more efficient control.

TRADE MARK: SANTON

Write or phone

SANTON LTD., NEWPORT, MON. *Tel. 71711 (10 lines)*

London : Sloane 2158 *Manchester : Central* 1394/5

Leeds 59361 *Birmingham : Midland* 6421 *Torquay* 7100

17161

NEWPORT SANTON MON ENG

OVER 142 MILES OF ELECTRIC CABLES

DUST EXTRACTORS
VENTILATORS
CONVEYORS
SIGNALLING SYSTEMS
TELEPHONES
LIGHTING

in

ARGENTINA'S NEW GRAIN ELEVATORS

WERE MADE BY

- Cables include 720,000 feet of V.R.I. and 35,000 feet of Armoured types.
- Installations were undertaken by the Anglo-Argentine General Electric Co. Ltd.
- The cables were supplied through our Agents, Messrs. Colsons, Brookhouse and Pyne, Ltda.
- These Elevators are at Villa Constitucion, Rosario South, Quequen and Ingeniero White.

B.I. Callender's

BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

"BROOK MOTORS

have saved us money on production costs by cutting down transmission losses. Working conditions are better too, and that's a vital factor in reducing labour turnover."

– SAYS

THE MANUFACTURER

Many factories, producing anything from light engineering to the finest textiles are converting their machines to individual electric motor driving. The flexibility of machine operation under fluctuating trade demands is a worthwhile consideration and the savings in maintenance charges will help to offset the cost of changing from group drive.

Surface Cooled Slip Ring

BROOK MOTORS Ltd

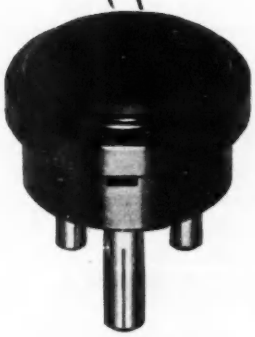
HUDDERSFIELD • ENGLAND

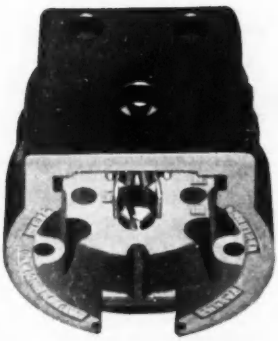
I.HZ.178

An easy-wiring

SHUTTERED

Switched Socket-outlet





IN producing a shuttered version of the "Lincoln" 15 amp. 3-pin top-entry switched socket-outlet, we have taken the opportunity to improve upon its easy-wiring features. The deeply recessed base eliminates the need for a mounting block and provides ample space for cable slack. Terminals are clearly marked to facilitate connection in the standard order and terminal screws are particularly easy of access. For surface wiring, the customary knock-out is replaced by an insert which can be removed at will to provide the wireman with a neat, smooth cable entry.

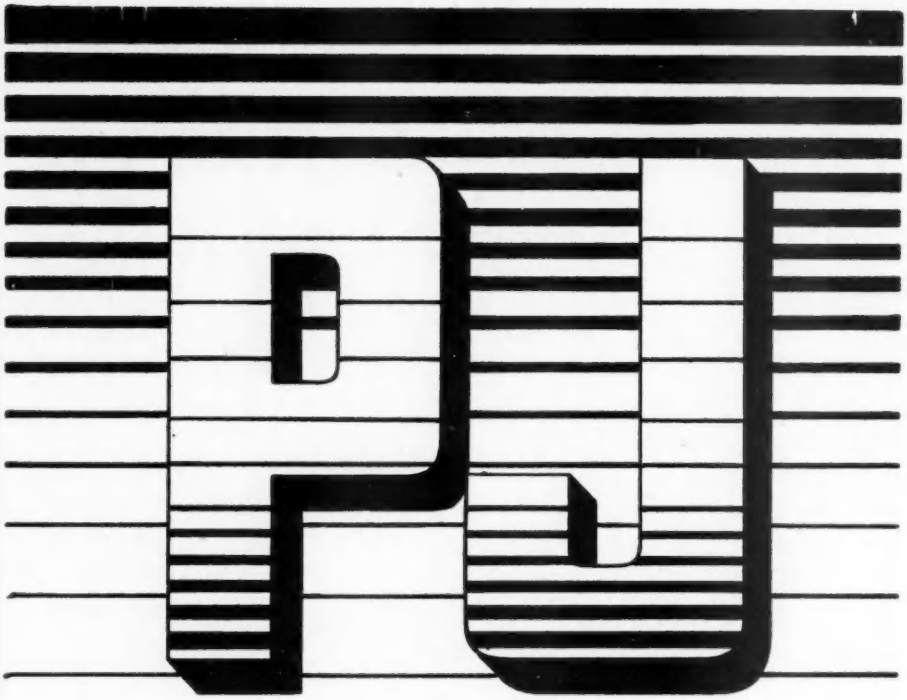
Listed Particulars
List No. 7490

Brown on White	141/8 per doz.
Brown	146/4 per doz.
White	164/– per doz.

CRABTREE

A · NAME · SYNONYMOUS · WITH · PROGRESS · IN · ACCESSORIES · AND · SWITCHGEAR

"Crabtree" (Registered) C.646/71 Advt. of J. A. Crabtree & Co. Ltd., Walsall, Staffs, England



Steel Sheets for the

Electrical Industries

PARTRIDGE, JONES & JOHN PATON LTD

PONTNEWYNYDD, NEAR PONTYPOOL

TELEPHONE PONTYPOOL 131/2

5710

C.M.A.-CABLES

In the air, on sea or on land, all scientific triumphs call for the finest and most reliable equipment.
Therefore when cables are required, always specify

C.M.A.

MEMBERS OF THE C.M.A. & AFFILIATED MANUFACTURERS' ASSOCIATIONS

British Insulated Callender's Cables Ltd.
Connollys (Blackley) Limited.
The Craigpark Electric Cable Company Limited.
Crompton Parkinson Limited.
Enfield Cables Limited.
The Edison Swan Electric Company Ltd.
Greengate & Irwell Rubber Company Limited.
W. T. Glover & Company Limited.
W. T. Henley's Telegraph Works Company Limited.
Johnson & Phillips Limited.
Liverpool Electric Cable Company Ltd.
Metropolitan Electric Cable & Construction Co. Ltd.
Pirelli-General Cable Works Limited (The General Electric Co. Ltd.).
Siemens Brothers & Company Limited (Siemens Electric Lamp & Supplies Limited).
St. Helens Cable & Rubber Company Ltd.
Standard Telephones & Cables Limited.
The Telegraph Construction and Maintenance Co. Ltd.

MAINS CABLE MANUFACTURERS ASSOCIATION
MAINS CABLE MANUFACTURERS ASSOCIATION (SUPER-TENSION)
RUBBER & THERMOPLASTIC CABLE MANUFACTURERS ASSOCIATION
Affiliated to
CABLE MAKERS ASSOCIATION
52-54 High Holborn, London, W.C.1. Tel: Holborn 7633

NEW DAY

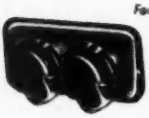
ELECTRICAL EQUIPMENT for Domestic Installations

CHOSEN FOR THEIR OUTSTANDING FUNCTIONAL, ENGINEERING AND AESTHETIC MERIT AND THEIR VALUABLE LABOUR-SAVING QUALITIES

Festival of Britain 1951 Design Review Reference Nos. 81.16.1./72 81.16.1./71 81.16.1./24 81.16.9./23

FIRESIDE triple SOCKET Serving three appliances at once.

SWITCH SOCKET For Ring-main or Circuit Wiring



DOUBLE TWIN TWO SOCKET Duplicates existing facilities

NEON PILOT CONTROL SWITCH For Immersion Heater Control

MICRO-GAP TUMBLER SWITCHES With Ball-bearing Mechanism

NEW DAY Electrical Accessories Ltd. 136-8 Mary St., Birmingham, 12.

HART ACCUMULATOR CO. LTD.,

Chequers Lane, Dagenham Dock, Essex

Manufacturers of

STORAGE BATTERIES FOR ELECTRIC LIGHTING AND POWER INSTALLATIONS

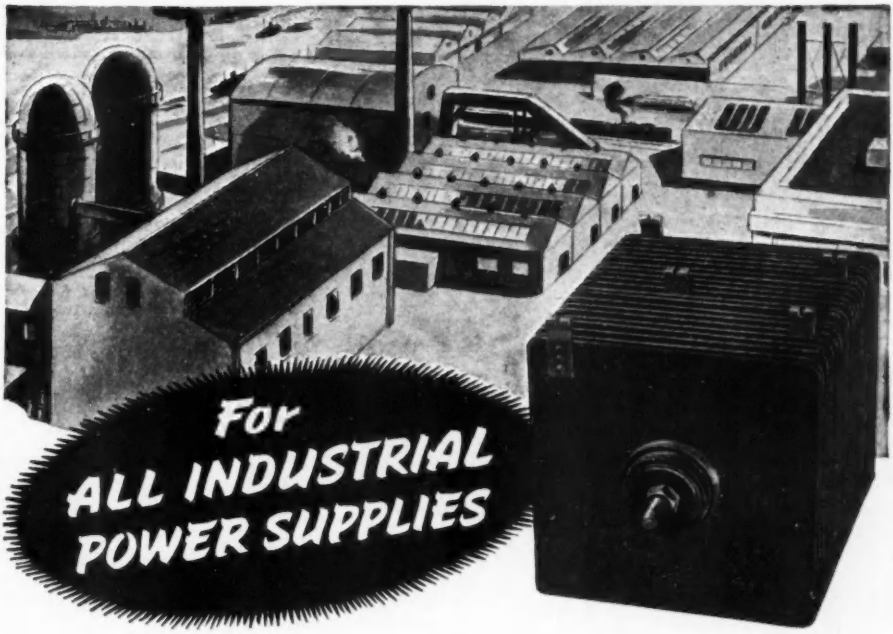
EMERGENCY LIGHTING EQUIPMENTS
for Hospitals, Cinemas, Theatres, Public Buildings, Hotels, Business Premises, Factories, Ships, etc.

PRICES ON APPLICATION

BY APPOINTMENT TO H.M. THE KING MAKERS OF ACCUMULATORS

Telephone: RAINHAM 34

Branches at Birmingham, Bristol, Cork, Dublin, Glasgow, Manchester, Newcastle-on-Tyne, Nottingham, and Westminster.



Whatever industry you operate, the same important factor confronts you. A really dependable D.C. power supply. This is where we can help you. As pioneers of metal rectification, our engineers have had to meet every problem of A.C. to D.C. conversion—low voltage heavy current—high voltage low current—medium power supplies—power for all electro-deposition processes—machine tools—battery charging and numerous other applications. This wide experience of conversion problems, coupled with rectifiers unequalled for efficiency and reliability, makes one fact certain—for reliable D.C. power you should install . . .

WESTINGHOUSE
WESTALITE

METAL RECTIFIERS

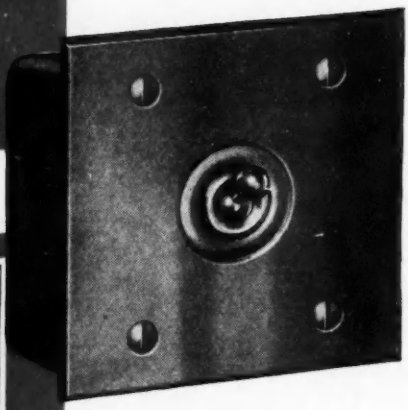
Write for Data Sheet No. 1 to Dept. E.T.9.

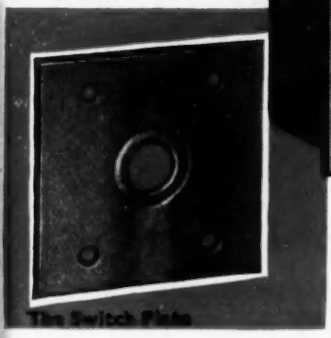
WESTINGHOUSE BRAKE & SIGNAL CO. LTD.

82 York Way, King's Cross, London, N.1

5 amp. & 15 amp. flush switch units

The Switch





The Switch Plate

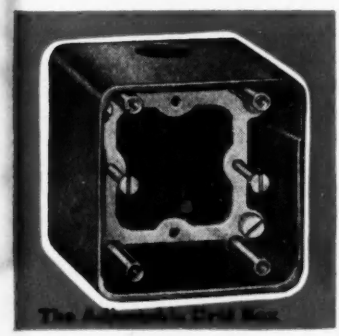
This flush switch unit is a worthy criterion of all BRITMAC products and is one of a large range of electrical accessories that has been supplied in quantity for schools, technical colleges, hospitals and other public buildings.

All BRITMAC ELECTRICAL ACCESSORIES are characterised by their strength, safety and efficiency over long periods and Installation Engineers who specify BRITMAC products by name are certain of the highest standard of quality, perfection of finish, coupled with a prompt and personal service.

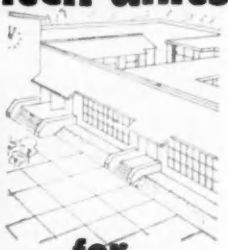
The Switch: This is the well-known 'Silomac' for use on a.c. current only and, as the name implies, is silent in operation.

The Switch Plate: Incorporates the cuttered-hole and four corner screws, dispensing with the need for a switch ring. For added safety, corner screws of a 'secret' pattern can be supplied.

The Adjustable Grid Box: Rigidly constructed and designed to give a wide margin of adjustment and the maximum space for wiring.



The Adjustable Grid Box



for schools

for hospitals

for public buildings

BRITMAC

BRITMAC ELECTRICAL CO. LTD.

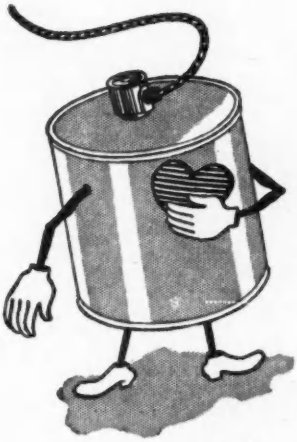
SALES ORGANISATION OF C. H. PARSONS LTD.

HEAD OFFICE · BRITANNIA WORKS · WHARFDALE ROAD · TYSELEY · BIRMINGHAM · 11

Telephone: ACOCKS GREEN 1191 (3 lines) · *Telegrams: "BRITMAC, BIRMINGHAM"*

London Office: *121, VICTORIA ST., LONDON, S.W.1. Telephone: VICTORIA 9778/9.*

Glasgow Offices: 247a ST. VINCENT ST. & 93 DOUGLAS ST., GLASGOW C.2. Tel.: CENTRAL 3445/6



Bless my 'heart' *said the Cistern*

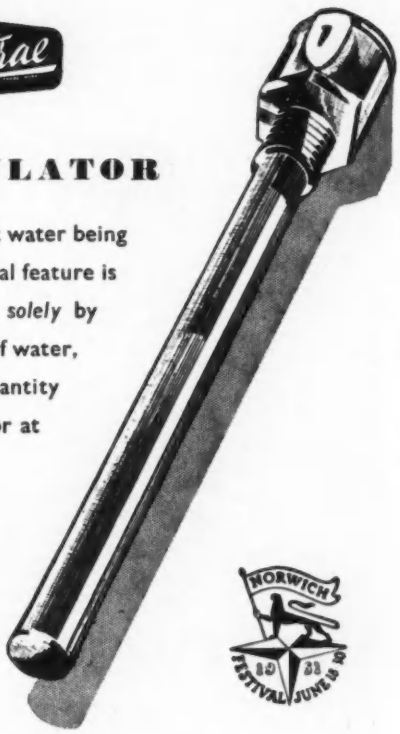
Thousands of cisterns have had new heart put into them, and thus improved circulation with a

Heatrae

AUTO-CIRCULATOR

This clever device ensures hot water being more speedily 'on tap.' A special feature is that the *thermostat is influenced solely* by the temperature of the main body of water, and not by that of the very small quantity of heated water in the draught tube or at top of cylinder.

Write us for our four-page **Leaflet DBE,** which gives valuable information on the matter of Circulators.



NORWICH FESTIVAL 23 JUNE 10

Heatrae

HEATRAE LTD. • NORWICH • ENGLAND

Manufacturers of: Electric Water Heaters, Oil Heaters, Immersion Heaters, Urns, Towel Rails, Airing Cupboard Heaters, Flame-proof Heating Apparatus, Breakfast Cookers, Electric Fires, Food Trolleys, Warming Plates, Air Heaters.

Lewcos
REGD

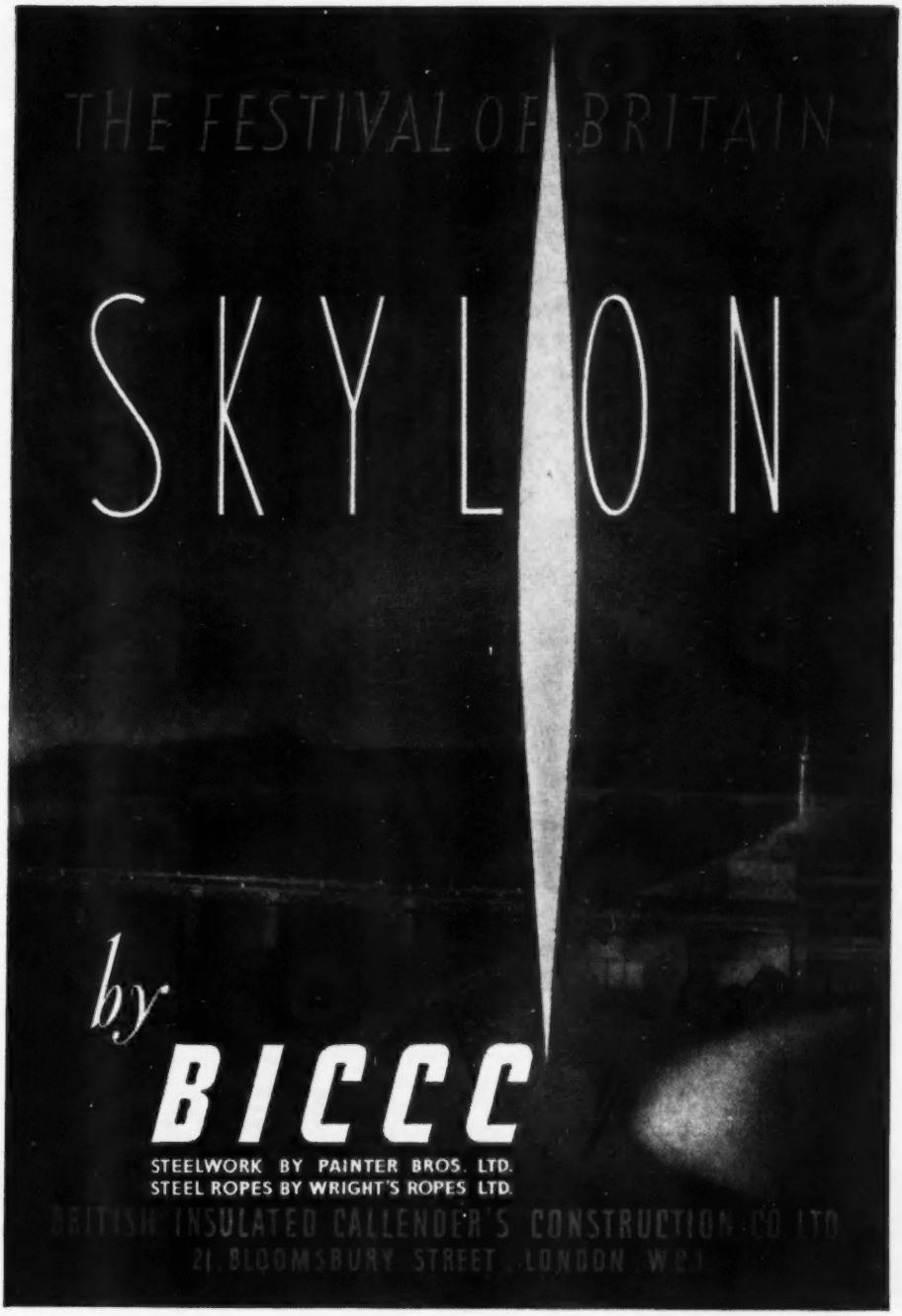
TEXTILE COVERED

WIRES & STRIPS

COTTON · SILK · PAPER

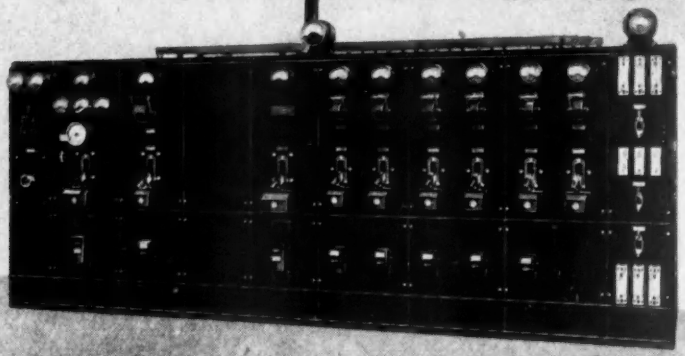
We shall be pleased to supply information or quote to your requirements.

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS, LIMITED
LEYTON, LONDON, E.10.
Incorporating FREDERICK SMITH AND COMPANY
Associated with THE LIVERPOOL ELECTRIC CABLE CO. LTD. AND VACTITE WIRE CO. LTD.


THE FESTIVAL OF BRITAIN
SKYLON
by
BICCC
STEELWORK BY PAINTER BROS. LTD.
STEEL ROPES BY WRIGHT'S ROPES LTD.
BRITISH INSULATED CALLENDER'S CONSTRUCTION CO LTD
21 BLOOMSBURY STREET LONDON WC1

MUDIE

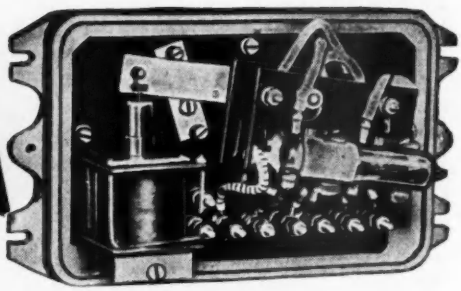
'DUPLICATE BUSBAR SYSTEM' SWITCH BOARDS



The above is a Work's Power House Switchboard for Steam Generation and Public Supply. For service on 400 Volts 3-phase 50 cycles.

MUDIE'S ELECTRICAL CO., LTD., BIRMINGHAM 28

For Efficient and Lasting SERVICE



Of extremely compact design, substantially mounted and well protected, ISENTHAL Relays are available in a range of Tilting and Vertical Plunger types, and can be relied upon to give efficient and dependable performance.

We will gladly supply full details upon request and our technicians are at your disposal to advise upon your problems.

ISENTHAL

ELECTRO-MAGNETIC RELAYS

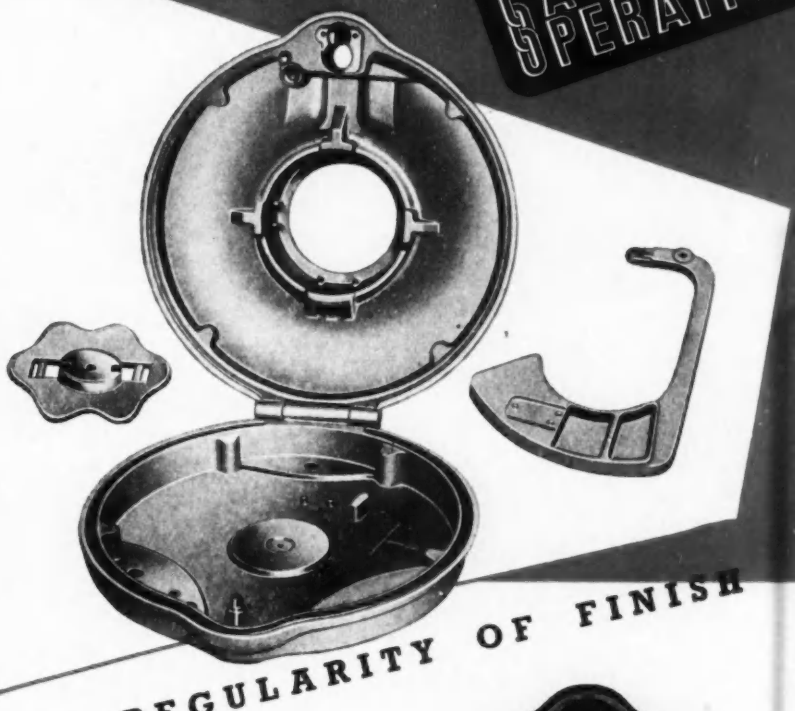
for operating Mercury Switches up to 30 amp

Enquiries should give all available technical details as our relays are extremely adaptable, and many sub-standard forms are available for special duties.

ISENTHAL & CO. LTD. Ducon Works, Victoria Road
NORTH ACTON, LONDON, W.3. *Telegrams: Isenthal, London. Telephone: ACOrn 3904*

IS.3

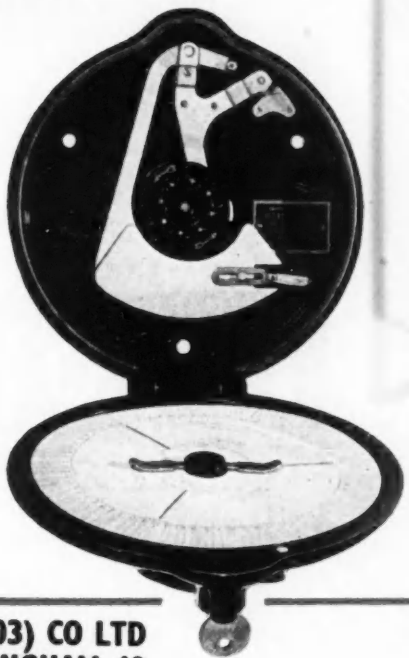
CASTING OPERATION



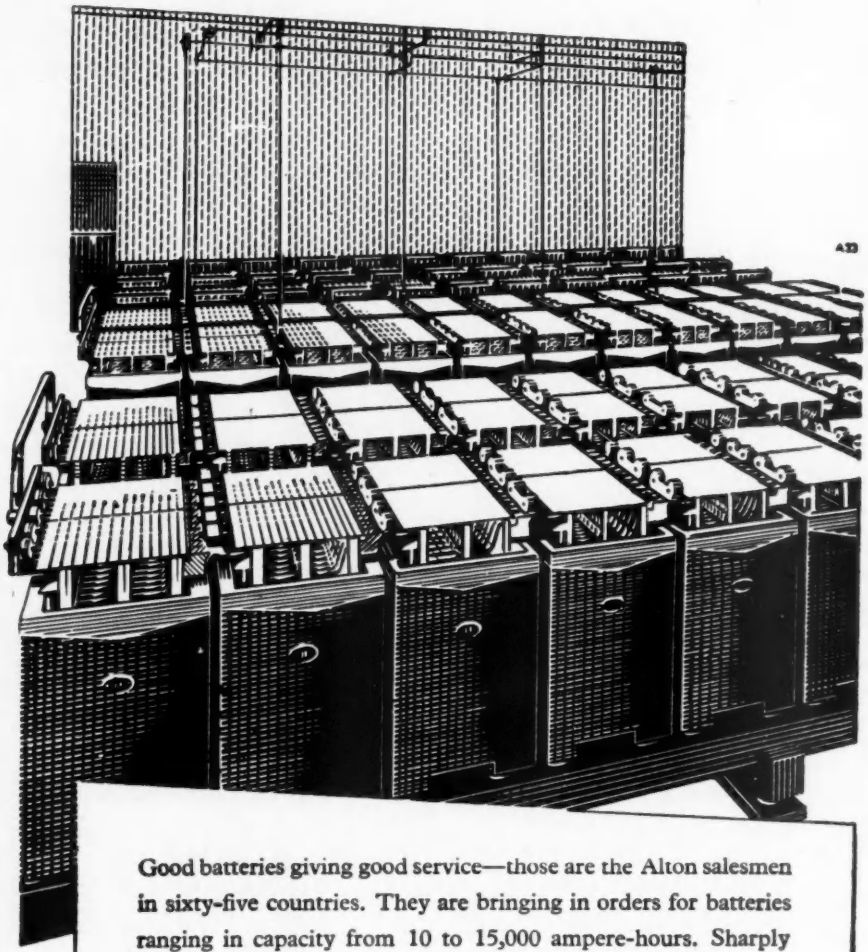
FOR REGULARITY OF FINISH

The illustration shows pressure die cast components for Servis Recorders. Our customer says, "We have been using your aluminium pressure castings for upwards of twenty years and we have found nothing to surpass them in regularity of finish. Our instruments are in use in all parts of the world and we have never yet had a single complaint regarding the parts you make for us. We have also come to appreciate and to rely on your Drawing Office and Design Staff, who have always been most helpful in the development of new types, and we look forward to continuing our co-operation with you for many years to come."

Extract from letter received from Servis Recorders, Gloucester.



BIRMINGHAM ALUMINIUM CASTING (1903) CO LTD
BIRMID WORKS · SMETHWICK · BIRMINGHAM 40



Good batteries giving good service—those are the Alton salesmen in sixty-five countries. They are bringing in orders for batteries ranging in capacity from 10 to 15,000 ampere-hours. Sharply increasing orders: but Alton, long experienced in export, is organised to meet them—with good batteries and firm delivery dates.

ALTON

Alton can also supply renewal plates for all makes of battery, British and Continental

BATTERIES OF MERIT

THE ALTON BATTERY CO. LTD

Alton, Hants. Telephone: Alton 2267 and 2268. Grams: Battery, Alton

ROYAL FESTIVAL HALL

This, probably the finest Concert Hall in the world, is an outstanding example of contemporary architecture and technical skill.

It is fitting that all equipment for the Hall should be the best that British industry can produce.

Accurate time throughout—unaffected by mains supply variations of power cuts—is provided by a

CHOSEN FOR THE FESTIVAL

Gents' of Leicester products chosen by the Council of Industrial Design for the South Bank Exhibition include Electric Clocks, Bells and Mine Signalling Equipment

GENTS' OF LEICESTER

CONTROLLED ELECTRIC CLOCK SYSTEM

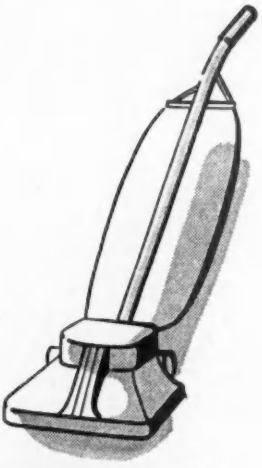
Full details are contained in Book 5, Section 1r, available on request

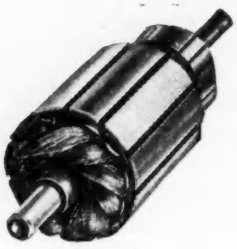
GENT & CO. LTD., FARADAY WORKS, LEICESTER

London: 47, Victoria Street, S.W.1 Newcastle: 1 Tangent House, Leazes Park Road

Products Include:—BELLS, INDICATORS, FIRE & BURGLAR ALARMS, WATCHMAN'S RECORDER SYSTEMS, LIQUID LEVEL CONTROL EQUIPMENT, 'PHONES, STAFF LOCATORS, PROCESS TIMERS, MINE SIGNALLING EQUIPMENT, TOWER CLOCKS

keep it going... ... longer





with "BICALEX" Winding Wire

It's the synthetic enamel covering that keeps "BICALEX" Winding Wires so reliable — for so long. They're ideal for high-speed winding... for jobs where abrasions are sometimes unavoidable. You can stretch, twist, and even flatten "BICALEX" Wire without damaging the insulation. No wonder it is used in some of the best vacuum cleaners, washing machines, and other domestic appliances built for long service.

May we send you details of the types and range of "BICALEX" Winding Wires in Publication No. 267V

BICC MAKE WINDING WIRES AND STRIP FOR EVERY ELECTRICAL PURPOSE.

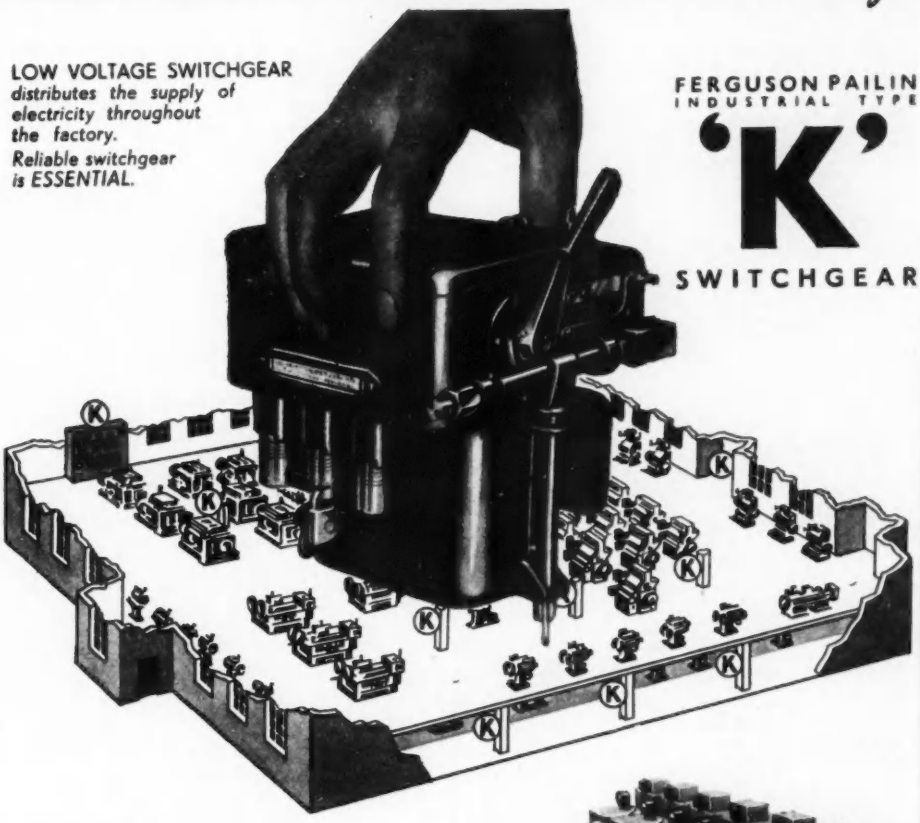
BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

B.I. Callender's A PRODUCT

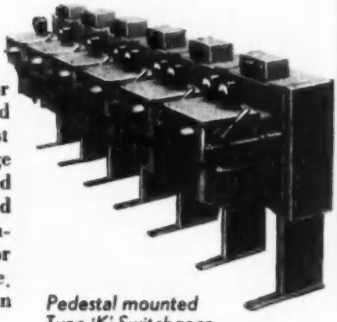
ELECTRICITY SUPPLY *within the Factory*

LOW VOLTAGE SWITCHGEAR
distributes the supply of electricity throughout the factory.
Reliable switchgear is ESSENTIAL.

FERGUSON PAILIN
INDUSTRIAL TYPE
'K'
SWITCHGEAR

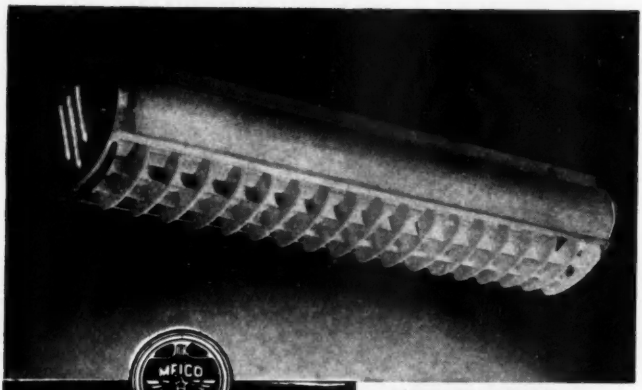


The provision of an adequate and reliable supply of power for plant operation and lighting in new factories, or extensions and modifications to existing plant arrangements should be a first consideration. In addition to their well-known high voltage designs, 'Ferguson Pailin' manufacture a range of fully tested type 'K' low voltage switchgear, for service up to 660 volts and fully conforming with the appropriate British Standard Specification. Units may be of the pedestal or cubicle type arranged for switchboard mounting; wall mounting designs are also available. Full information on this type of switchgear will be gladly sent on request to interested Executives or responsible officials.



Pedestal mounted Type 'K' Switchgear

FERGUSON PAILIN LTD.
MEMBER OF THE A.E.I. GROUP OF COMPANIES
Switchgear Specialists
MANCHESTER, 11. ENGLAND



Cold Cathode establishes a special place in the field of lighting, due to their high efficiency and adaptability, with considerably longer life, instant starting, and their ability to operate on reduced supply voltage. A comprehensive range of MEICO Fittings and combinations in "U" Tubes, 3 ft. Grid and Straight Tubes. Illustrated and informative catalogues available on request.

MICRAMATIC LIMITED

WOOTTON MOUNT
OLD CHRISTCHURCH ROAD
BOURNEMOUTH

MEICO *Cold Cathode* LUMINAIRES

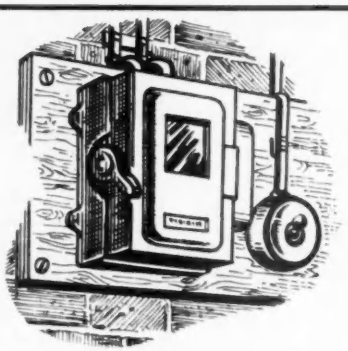
WORKS CONGLETON CHESHIRE
BRANCHES AT LONDON · LEEDS · GLASGOW

SINGLE POLE AND NEUTRAL GEAR

by

SANDERS
WEDNESBURY

METAL CLAD SWITCH FUSE FOR CONDUIT ENTRY. 15 AMP. FUSE
LIST NO. N.101 RC.



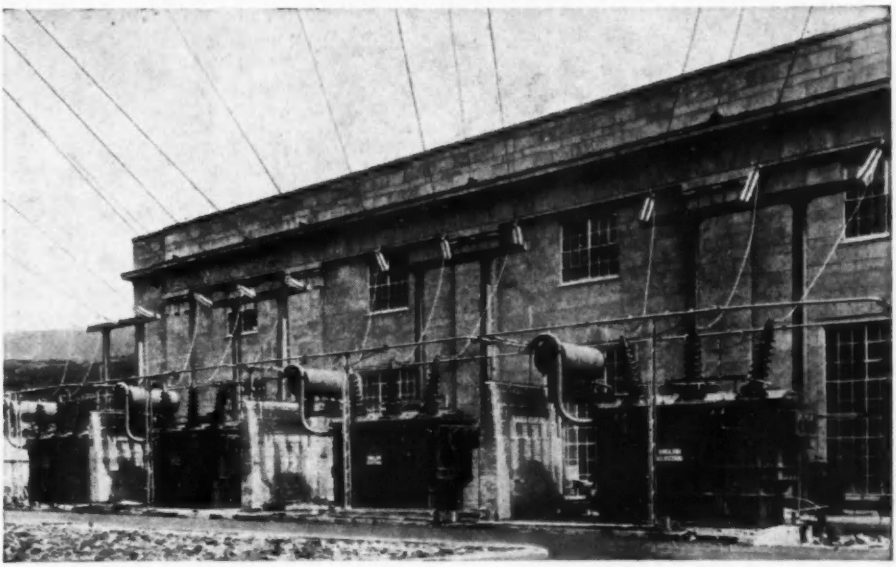
CONTROLLING FACTORS!
moulded rubber components....
better be certain and specify

Dainite

THE HARBORO' RUBBER Co. Ltd., MARKET HARBOROUGH

'ENGLISH ELECTRIC'

transformers



Scotland's latest and largest hydro-electric power source, the Loch Sloy scheme, has been equipped almost in its entirety by 'English Electric'. With an output of 130,000-kW from its four generators, the station depends on other 'English Electric' equipment for the control of output and distribution.

Power is generated at 11-kV and is stepped-up to 132-kV for delivery to the transmission lines via four 'English Electric' type OFW transformers each of 35,000-kVA rating. These transformers are typical of many similar 'English Electric' installations throughout the world.

The English Electric Company design and manufacture transformers of all types, up to the largest size and highest voltage.

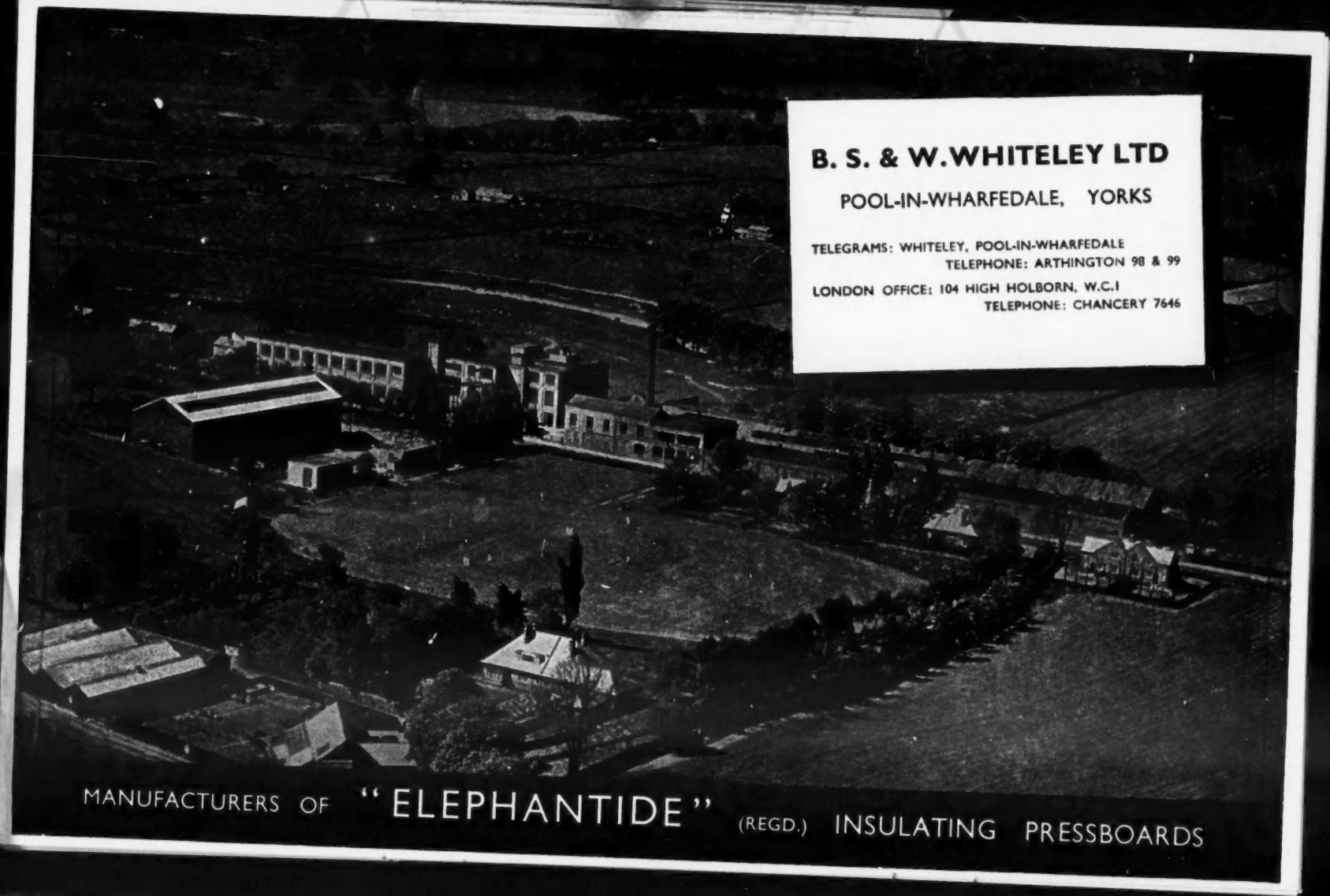
The ENGLISH ELECTRIC Company Limited

QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Transformer Department, Stafford

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL

TH.I.


B. S. & W. WHITELEY LTD
POOL-IN-WHARFEDALE, YORKS
TELEGRAMS: WHITELEY, POOL-IN-WHARFEDALE
TELEPHONE: ARTHINGTON 98 & 99
LONDON OFFICE: 104 HIGH HOLBORN, W.C.1
TELEPHONE: CHANCERY 7646
MANUFACTURERS OF "ELEPHANTIDE" (REGD.) INSULATING PRESSBOARDS

Photograph shows comparative size with a 12 inch ruler

MEASUREMENT POLYPHASE METERS

Type ZF.33, 3 wire, and ZF.34, 4 wire. Patented single disc design • Low interaction • High torque/weight ratio • Voltage and temperature compensated • Compact and robust • Accessible adjustments • Torque balance on each element.

An addition to the range of Measurement Electricity meters

MEASUREMENT LTD., TAMESIDE WORKS, DOBCROSS, OLDHAM

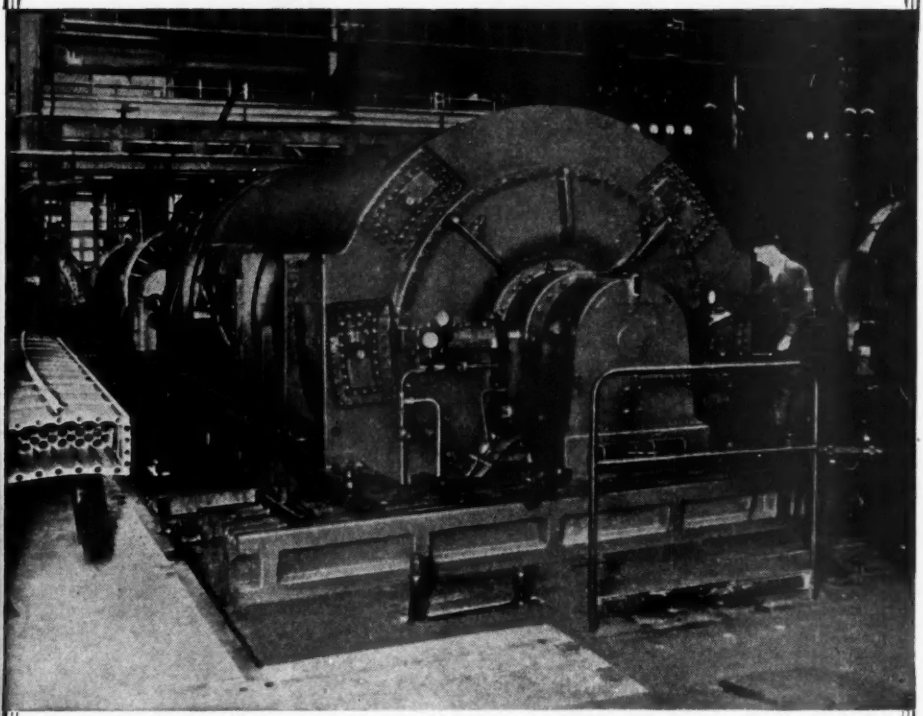
Telephone: Delph 291-2 *Telegrams: Supermeter Dobcross*

LONDON OFFICE: Terminal House, 52, Grosvenor Gardens, S.W.1
Telephone: Sloane 8271

A Company of the Parkinson & Cowan Group

Storrow & Bowden

WAKEFIELD OIL FOR INDUSTRY



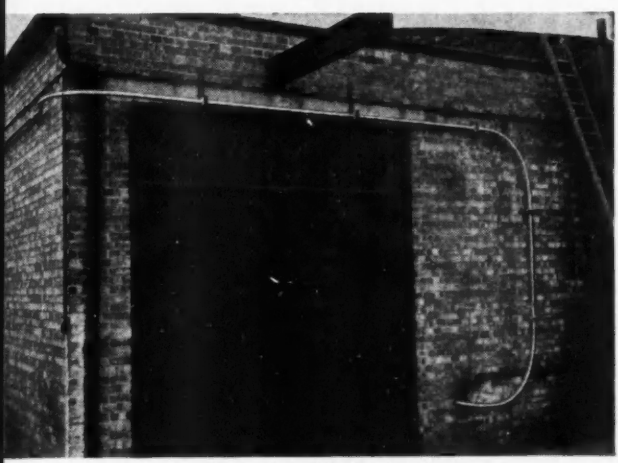
The first hydrogen-cooled turbo-alternator to be permanently installed in Europe, the 60,000 kW Metropolitan Vickers set at the Littlebrook Station. Lubricated with Wakefield Perfecto Special X

British Electricity Authority use

C. C. WAKEFIELD AND COMPANY LIMITED · LONDON · W.1

INSTALLING A LENGTH OF 0·25 SQ. IN. 4-CORE CABLE.

STRAIGHTENING THE CABLE AFTER CLEATING IN POSITION.



THE COMPLETED INSTALLATION.

TECHNIQUE *for installing*

J.&P.

ALUMINIUM SHEATHED CABLES

...ABOVE GROUND

J. & P. Aluminium Sheathed Cables offer very great technical, as well as economic, advantages for surface installations. The strength of the sheath and its resistance to atmospheric corrosion enable cables to be installed bare and unarmoured, and the reduction in weight permits fewer and lighter fixings to be used.

Some variation from the installation technique normally used for lead sheathed cables is often advantageous, and fresh thought should be given to the choice of route. The increased span lengths permissible due to the greater rigidity and lighter weight of the cable allow routes to be adopted which would be impracticable for lead. On the other hand, care is necessary, especially with larger cables, in imposing sharp bends, and radii below 15 x cable diameter should be avoided if possible. The photographs alongside show stages in a typical installation, and indicate the ease with which the cable is handled by a small gang of men.

Supporting fittings may be wood (aluminium is immune from attack by wood acids) or porcelain, galvanised iron or aluminium; and, as spacing is not critical, the same support centres can be used for a number of cables of widely differing sizes.

A turning Point in Cable Engineering

British Patent Nos. 627815 & 627793.

JOHNSON & PHILLIPS LTD.

CHARLTON LONDON S.E.7

The mark that means that "little more" in quality

Efficient TROUGH LIGHTING

Industrially yours

SB

OPEN END TROUGH

Cat. No. O.T. 14. Single 4'-40W. Lamp
Cat. No. O.T. 24. Twin 4'-40W. Lamps
(Also available in 5'-80W. Single or Twin Lamps)

Reflector manufactured from Duralumin and finished internally White, externally Grey stoved enamel . . .

CLOSED END TROUGH

Cat. No. C.T. 15. Single 5'-80W. Lamp
Cat. No. C.T. 25. Twin 5'-80W. Lamps

Manufactured in one piece from Aluminium, overall finish White stoved enamel.

If you have any LIGHTING PROBLEMS — Consult our TECHNICAL DEPT.

For Full Details and EXPORT PRICES write to :—

SMART & BROWN (ENGINEERS) LIMITED

TRADING ESTATE, SPENNYMOOR, CO. DURHAM

— but there are more than 2000 standard motors in the C. P. range

See our exhibits on Stand C.609 at the B.I.F. BIRMINGHAM April 30-May 11

Crompton Parkinson LIMITED

CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2.
Phone: CHAncery 3333 *Grams: Crompark, Estrand, London.*

ELECTRICAL EQUIPMENT

INDICATING CONTROL UNITS

by

ARROW

THE demand for compact robust but inexpensive Control Units with warning pilot light is met by ARROW. Ideal for controlling water heaters, motors, fans, heating elements and many other installations, these new ARROW Units are superbly finished in White stoved enamel with Red protective bulls' eyes and built to the ARROW high standards which ensure such dependable service . . .

TUMBLER TYPE
Double Pole On - Off
30 A 250 V AC/DC
With fused pilot light.

ROTARY TYPE
Double Pole Series Parallel
15 or 20 A 250 V AC/DC
With fused pilot light.

Easy to instal — easy to wire

Write for full particulars

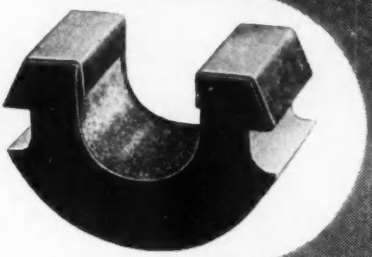
ARROW ELECTRIC SWITCHES LTD

HANGER LANE EALING
LONDON · W.5
Telephone : Perivale 4451

THE FM METER

FERRANTI

BRAKE MAGNET



The unequalled performance of the Ferranti F.M. Meter is largely due to an anisotropic magnet of unusual power having 14 times the magnetic energy of Tungsten steel and 4 times that of 35% Cobalt.

FERRANTI LTD.

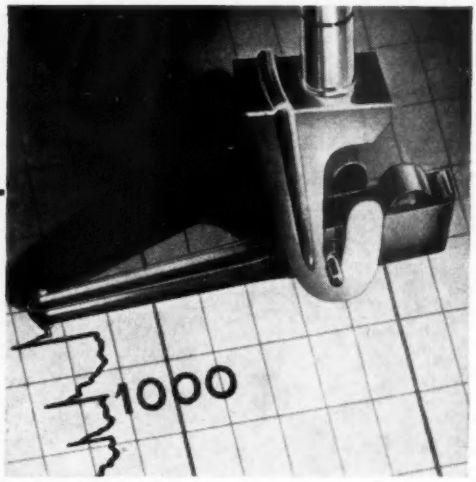
HOLLINWOOD · LANCASHIRE · ENGLAND

FM94

London Office: Kern House, Kingsway, W.C.2.

All the facts—All the time

Pen-pointed by EVERSHED



Efficient production programmes can only be based on accurate details of plant operation, and such precise details are best obtained by the use of Evershed Recorders.

Evershed Recorders measure electrical quantities, such as current pressure, power, frequency, power factor: mechanical quantities such as speed or water level: or plot automatically on a time basis a given operation, or a combination of an operation with a quantity record.

Fixed or portable, they can save manpower by operating in any unattended position. Single or multi-pen, they will record one single operation or a number of operations which it is desired to compare.

A few of the many purposes for which Evershed Recorders are now being used:

New Zealand railways keep a permanent record of shunting operations and thus study the most efficient methods.

The Post Office Engineering Dept. records the volume of telephone traffic.

The British Electricity Authority records the output of generators, consumer demands, purity of boiler feed water and other valuable data.

Water and sewage undertakings keep accurate records of the number of pumps in operation at any time.

Railways and tramways use Evershed Recorders to carry out traction tests.

There is a wide range of Evershed Recorders and special instruments can be designed to meet unusual problems. They are described in detail in Publication J222.

EVERSHED

CENTRALISED INFORMATION AND CONTROL FOR PRODUCTION EFFICIENCY

Evershed & Vignoles Limited

ACTON LANE WORKS, CHISWICK, LONDON, W.4.

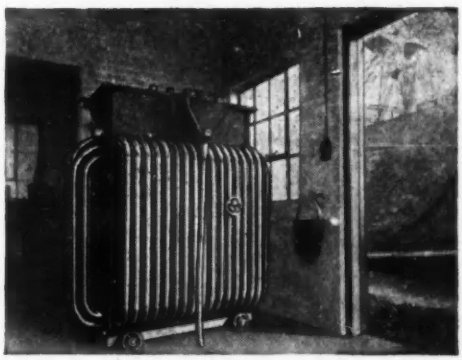
Telephone: Chiswick 3670 *Telegrams: Megger, Chisk, London* *Cables: Megger, London*

6/2

Electric Equipment for Mining

Transformers

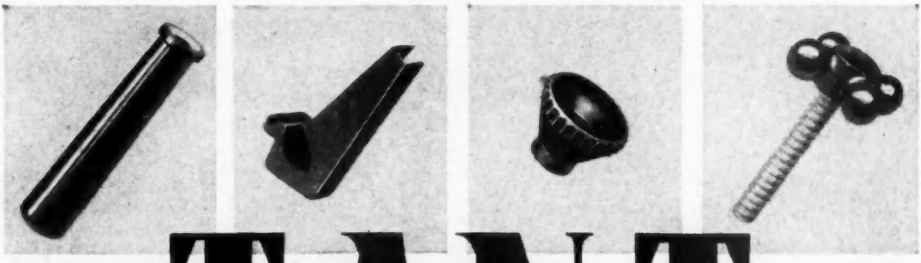
From important substations down to small portable units, BTH can supply transformers which will give years of trouble-free service. Rigid control of raw materials—quality of design—soundness of mechanical construction, are but a few of the contributing factors which have made BTH transformers popular in mining fields all over the world. BTH have been installing equipment in mines for half a century, and one reason for their world-wide reputation is the extensive research undertaken into the requirements of the mining industry. Backed by unrivalled manufacturing resources, BTH is today taking a leading part in the supply of equipment for reconstruction and modernisation schemes both in this country and abroad.



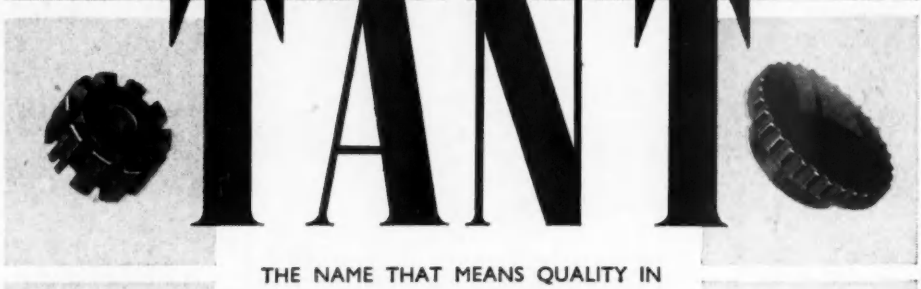
BTH 600-kVA, 6600/3000-volt indoor type transformer in a Staffordshire Colliery substation.

THE
BRITISH THOMSON-HOUSTON
COMPANY LIMITED, RUGBY, ENGLAND
Member of the AEI group of companies

AEB
C

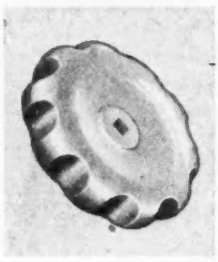


TANT



THE NAME THAT MEANS QUALITY IN

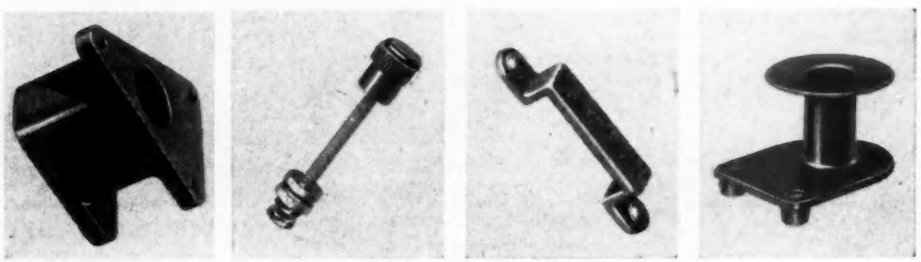
PLASTICS



For your Plastics remember that Tants, who are noted for technical accuracy and delivery, offer you the benefit of over 40 years experience and a modern plant with a splendidly equipped tool-room. No subject or problem is too difficult for them.

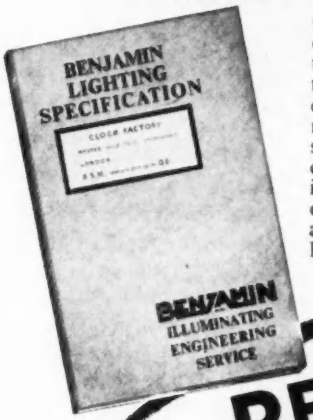
W. H. TANT & CO. LTD.
PIONEER PLASTIC HOUSE
TRANSANT WORKS, DOLLMAN STREET,
BIRMINGHAM 7

Telephone: ASTON CROSS 3232/3
Telegrams: "TANTAMOUNT B'HAM"



HOW TO MAKE SURE OF GOOD LIGHTING

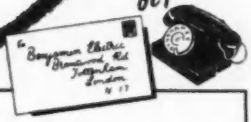
Avail yourself of the best experience....



Good Lighting doesn't just " happen." It is the result of right planning, following an expert survey which takes every item into account—the layout of the plant, the type of work being carried out and the seeing conditions of the operatives. The Benjamin Illuminating Engineering Service does all this and then submits a specification, complete with drawings and explanatory details, so that you can know exactly what is required. This Service is entirely without cost or obligation to you, of course, and is immediately available wherever you are situated. Why not contact Benjamin now!

BENJAMIN REGD. ILLUMINATING ENGINEERING SERVICE

Just write or phone



THE BENJAMIN ELECTRIC LTD
(*Established* 1908)
Brantwood Road, Tottenham, London, N.17
Telephone: Tottenham 5252 (5 *lines*)
Telegrams: ' Benjalect, Southtot, London.'

BIRMINGHAM
5, Corporation St., Birmingham 2
Midland 5197

LEEDS
49, Basinghall St., Leeds 1
Leeds 25579

SMITH prepayment METERS

measure accurately

Accuracy is inherent in all Smith Meters; the Variable Tariff Prepayment Meter, illustrated, combines rigidity of construction with simplicity of action. Twenty years of success with this meter has justified Bakelite enclosures.

Easy variable tariff adjustment

Simple, positive coin action

Switch withstands heavy overloads

Quick, safe, switch break

Single unit construction

Accuracy of registration unaffected by Prepayment mechanism

Specify

SMITH METERS

SMITHS METERS LTD · ROWAN RD · STREATHAM VALE · LONDON · SW16
also in LEEDS and DUNBLANE, PERTHSHIRE

ELECTRICAL TIMES

Vol. 119 No. 3105 THURSDAY 10 MAY, 1951

PUBLISHED EVERY THURSDAY

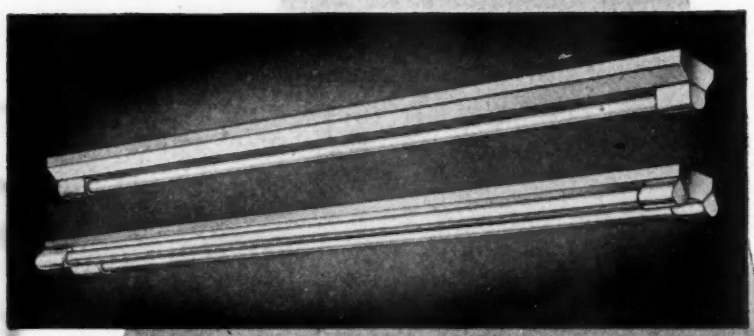
SIXTIETH YEAR OF PUBLICATION

VOLTAGE REGULATIONS OF L.V. UNDERGROUND CABLE SYSTEMS *by J. G. Boggis, A.M.I.E.E., G.I.Mech.E.* 775
OUR READERS' VIEWS 778
ANOTHER LOOK AT THE FESTIVAL CELEBRATIONS 779
EUROPEAN SUPPLY CO-OPERATION 780
FESTIVAL FLOODLIGHTING 781
B.I.F.—SOME IMPRESSIONS AT CASTLE BROMWICH 782
MEASURING R.R.R.V. 785
HIGH POWER FUSES ARE REWIREABLE 786
B.T.H. RESEARCH IN 1950 787
PROBLEMS AND PRACTICE IN ENGINEERING 789
ISOTOPES FOR INDUSTRY 791
OVERSEAS NEWS 794
PERSONALITIES IN THE INDUSTRY 796
NEW LITERATURE 798
FASTER FLASHES.. 799
WORKERS IN NATIONALISED INDUSTRY 801
HAVE POLITICIANS CAUSED THE SHORTAGE? 802
THE BUYER'S COLUMN 803
ELECTRICAL EQUIPMENT FOR THE "OCEAN MONARCH" 805
THE WEEK IN NEWS 806
Questions in Parliament 810
Electric Supply News 810
Company Activities 811
COMMERCIAL INFORMATION 812
CLASSIFIED ADVERTISEMENTS 53
INDEX TO ADVERTISERS.. 62

SUBSCRIPTION RATES.—United Kingdom and Overseas £1 17s. 6d. per annum. Canada C$5·50, U.S.A. $5·50 per annum. Subscriptions are payable in advance and may commence with any issue throughout the year. Overseas subscriptions may be paid to The Electrical Times Limited by banker's draft, cheque or international money order. Single copies 6d. each.

OFFICES — SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telephone - HOLborn 6016 Telegrams - Equivolt, Estrand, London

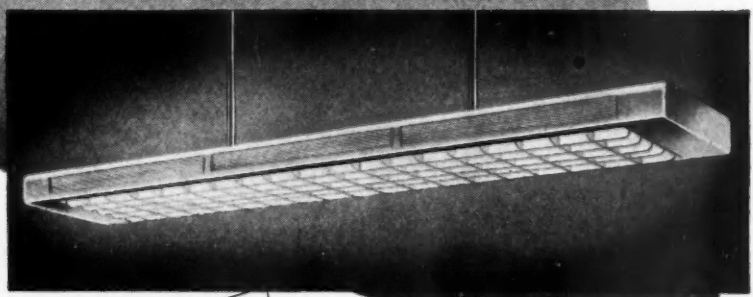
Fluorescent



F62031
1 Light, 8 ft., 125 watt. Ceiling fitting.

F62032
As F62031 but arranged to accommodate 2 Lamps.

Fittings



F41016
Decorative Louvre Pendant for 2, 80 Watt. 5 ft. Lamps.

by G.E.C.

available in a range of over one hundred distinctive units.

Remember the G.E.C. facilities for the manufacture of individually designed fittings, and an unsurpassed Lighting Advisory Service which is available to architects at all times.

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

Editorial

STILL WATERS

IN international affairs, publicity is a poor measure of success: agreement reached by painstaking effort makes dull news when compared with the scintillating polemics of a clash of opinion. As a result, few people realise the good work being carried out by a distant relation of U.N.O.—the Committee on Electric Power of the Economic Commission for Europe. It must be admitted that its work is hardly inspiring to the general reader or the practical engineer, but that is in some ways another measure of its usefulness. Unheated consideration of such legal problems as laws to govern the sale of electric power across international frontiers, and the hydro-electric development of rivers of common interest must always be preferable to *ad hoc* decisions in the glaring light of "considerations of national honour." So far few decisions of direct importance to this country have been taken by the Committee, but with cross-Channel power transmission and long-distance d.c. working exercising the imagination of the more courageous engineers, the time may soon come when its services will prove of first-rate value to Great Britain.

OUTLOOK FOR COAL

FUEL stocks are an unseasonable subject for the Whitsun holiday, but they are deserving of attention just now. Progress in the stockpiling of coal during the coming months of summer and early autumn will determine the probability next winter of headlines proclaiming "Power stations down to two weeks' stocks." Last October's available stocks of 4·3m. tons proved to be equivalent to five weeks' supply at the average weekly winter consumption. Judging by the events of recent years, eight weeks' supply is necessary for comfortable security, and six to avoid complete dependence on the weather. With the increased fuel requirements of the supply industry to be expected next winter as a result of natural growth of demand combined with increase in generating capacity, eight weeks' supply will be 6·8m. tons in a wet, cold winter. Attainment of this level will require stockpiling at the rate of 160,000 tons/week, giving a 4·2m. ton increase from the 1951 lowest to highest totals. Even the remarkable recovery after the 1947 disaster only achieved a 3m. ton summer increase in power station stocks, and conditions then were probably more favourable than they are today. The difficulty is increased because of the effects of wet weather on open-cast mining, which has a disappointing record in 1951 so far, and is of special importance for the supply industry. Power station stocks stayed steady to within a few per cent from the middle of January to the middle of April: since then they have risen appreciably. The extent of their increase during the next few months undoubtedly holds the seeds of the story of our strength and comfort in the winter to come.

ISOTOPICS

THE conference on radio-active isotopes in industry, reported elsewhere in this issue, was both timely and well balanced. Timely, in that it gave prominence to a number of industrial uses for these substances which have hitherto been familiar only to specialists, and not to the average engineer, whose horizon has been limited to their uses as tracers, or substitutes for X-rays. It was well balanced, since papers were divided equally between the proposals of those whose interests lie in the production and marketing of isotopes, and the practical viewpoint of industrialists who regard them as a means to an end. Meteor hopes, however, that isotopes will not be seized upon as a new toy and loosely regarded as a cure for all the ills which industry is heir

to—as was electronics a decade or so ago. Too-hasty application in the workshop of methods and materials more suited to the laboratory often brings new and useful techniques into disrepute and, instead of assisting in their development, rather retards it. Let us, then, make haste slowly, and, in assessing the potentialities of isotopes to general industrial problems, let us not confuse what is possible with what is practicable.

MUSEUM IMPROVEMENT

SCIENCE in the Festival of Britain appropriately has its shrine at South Kensington, with an exhibition next door to the Science Museum. Though the museum authorities have had no direct responsibility for this display, they will be affected by its success, since the exit from the temporary exhibition leads into the museum galleries, and an increase in museum attendance is to be expected. Regular readers of these notes may recall that in December, 1948, Meteor commented on the unsatisfactory representation of electrical engineering in the Science Museum collections, and may wonder if matters have improved in time to meet this increased attention. The answer is undoubtedly "yes," though much remains to be done. Most important of noticeable changes is the increased representation of modern electrical equipment: motors, circuit-breakers and control gear of types to be found in the most recently equipped factories are on show, some of them as working demonstrations. Evidently the industry has realised the need for more attention to this national show-place, and assistance in kind has been given. Space is still restricted—expansion may come when the Festival exhibition is over—but the electrical collection is, happily, no longer the crying shame of three years ago.

INHIBITIONS?

THE addition of inhibiting agents to insulating oil, to reduce the tendencies to oxidation and sludging, does not appear to have received the widespread attention in Britain that has been focused upon it in the U.S. Results obtained with an inhibitor known as D.B.P.C. (or di-tert-butyl-para-cresol for short) which has been used in the turbine field for some years, were reported in the *Electrical World* nearly a year ago, and showed some remarkable improvements in the rate of oxidation under test conditions as compared with uninhibited or "straight" oils of similar grade. Under oxidation test at 95° C., a period of five days to breaking point on uninhibited oil was extended to 24 days using 0·5% of the inhibitor, while an addition of 1·5% increased the period apparently indefinitely. Even with reclaimed oil under the same conditions, 1·5% addition gave something like 16 times the life before sludging commenced. At first glance, it would appear that the subject would be of considerable interest to British engineers.

SILENCE NOT IGNORANCE

THE fact that little has been said in this country on the subject, however, does not mean that the problem has been ignored. One very good reason for the apparent lack of interest is that "straight" oils (with the possible exception of acidity troubles in the obsolete class "A" oils) have been, on the whole, satisfactory. Since a love of change for its own sake has never been a national characteristic, the incentive towards widespread use of inhibitors has not been strong enough to counteract possible doubts about the advisability of mixing oils, and the inconvenience which would arise if it were necessary to restrict sources of supply for this reason. Nevertheless, the subject is by no means being ignored. The B.S.I. have already taken official cognisance of it in the 1951 issue of B.S.S. 148, to prevent inhibitors being used to bolster up poor-quality oil. Also the E.R.A. are carrying out field trials on an extensive scale. It will be some time before they will be able to report on these, but we feel confident that when this report appears, we shall find that we know quite a lot about the pros and cons of inhibited oils.

Meteor

Voltage Regulation of L.V. Underground Cable Systems

SIMPLE METHODS OF CALCULATION

By J. G. BOGGIS, A.M.I.E.E., G.I.Mech.E.

BEFORE connecting additional loads to a l.v. underground cable* system, it is necessary to check that the voltage regulation will not be excessive. For this purpose, simple methods of calculation are required which give reasonable accuracy without lengthy computation.

Resistance

The maximum resistance, including 2% for the lay of the cores in multi-core cables

$$= \frac{0{\cdot}025}{A} \text{ ohms/1,000 yards} \quad \ldots\ldots\ldots (1)$$

The standard resistance of annealed copper at 60° F. $= \frac{0{\cdot}024}{A}$ ohms/1,000 yards,

where A is the area in sq. in. ..... (2)

The error caused by using the nominal area of B.S. conductors instead of the calculated area (e.g. 0·3 instead of the correct 0·3024 sq. in.) does not exceed 2%, excepting for 1·0 sq in. Resistance at a temperature t°F

$$= R_{60}\left[1+\frac{(t-60)}{450}\right] \text{ohms} \quad \ldots\ldots (3)$$

To apply the temperature correction, it is necessary to assume a conductor temperature. Table I, calculated from the temperature rises allowed in E.R.A. report F/T.128 for three and four-core a.c. cables, may be used as a guide. Multiply the resistance at 60° F. by the factor given in the table.

TABLE I.—Temperature Factors for 3- and 4-core A.C. Cables

How laid underground	Per cent of permissible current rating Steady loading conditions				
	125	100	75	50	25
Armoured, laid direct	1·35	1·22	1·12	1·06	1·01
Armoured, in ducts ...	1·35	1·22	1·12	1·06	1·01
Plain lead, in ducts ...	1·22	1·14	1·08	1·04	1·01

Skin and proximity effects may be neglected, excepting for large section cables (say 0·5 sq in. and above), for which they may be significant.

Reactance

The reactance of multi-core cables manufactured to B.S. 480 : 1942, 660-volt class, may be assumed, with sufficient accuracy, to be constant at 0·0625 ohms/1,000 yards at 50 c/s. Small section cables have higher reactance, e.g. 0·08 ohms for 0·0225 sq in., but as their resistance/reactance ratio is high the resulting error is small.

Single-core cables have, of course, a higher reactance, which is a function of the spacing between the cable centres.

Mutual inductive effects between the cores will be ignored, i.e. each core will be assumed to have an inductance which is independent of the currents flowing in the neighbouring cores.

Regulation

Let E = Sending end voltage, vector volts.
" V = Receiving end voltage, the reference vector.
" I = Load current = I(cos φ — j sin φ) vector amps.
" Z = R + jX = cable impedance, vector ohms.

Then $E = V + I.Z = V + (P + jQ)$ ..... (4)

where P = real part of I.Z
and Q = imaginary part of I.Z.

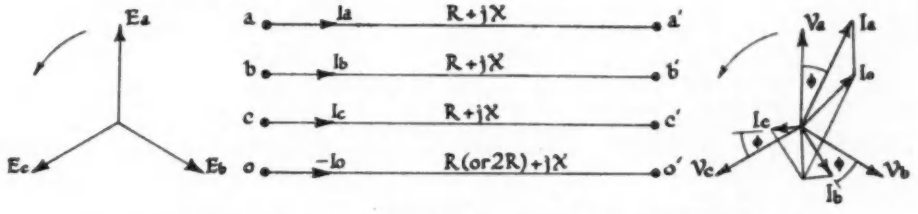
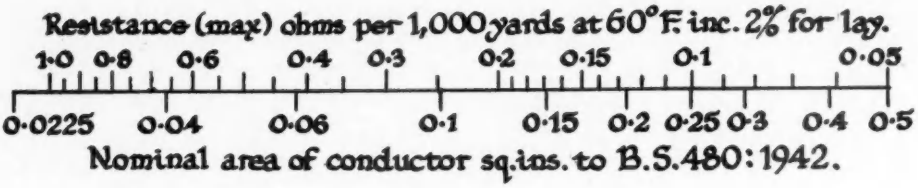
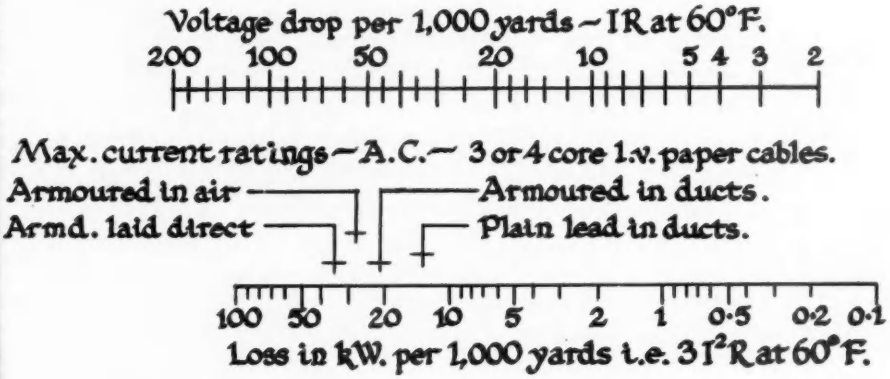
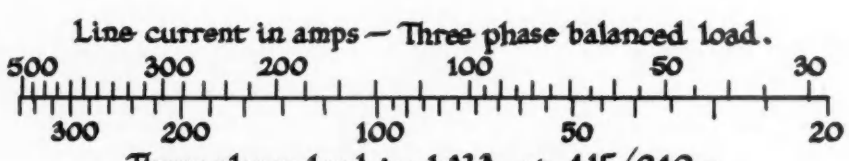


Fig. 1. Vector diagram of an unbalanced load on a three-phase, four-wire circuit


Resistance (max) ohms per 1,000 yards at 60°F. inc. 2% for lay.
1·0 0·8 0·6 0·4 0·3 0·2 0·15 0·1 0·05
0·0225 0·04 0·06 0·1 0·15 0·2 0·25 0·3 0·4 0·5
Nominal area of conductor sq.ins. to B.S.480: 1942.

NOMOGRAM: data for l.v. paper insulated cables. J.B.


Voltage drop per 1,000 yards – IR at 60°F.
200 100 50 20 10 5 4 3 2
Max. current ratings – A.C. – 3 or 4 core l.v. paper cables.
Armoured in air
Armd. laid direct
Armoured in ducts.
Plain lead in ducts.
100 50 20 10 5 2 1 0·5 0·2 0·1
Loss in kW. per 1,000 yards i.e. 3I²R at 60°F.



Therefore $E^2=(V+P)^2+Q^2$ ....(5), from (4)
$=V^2+2PV+P^2+Q^2$

Solving this quadratic for V we have

$$V=-P+\sqrt{E^2-Q^2}=E-P-\frac{Q^2}{2E}-\frac{Q^4}{8E^3}\text{ etc...}(6)$$

As a first approximation, Q/E being a small quantity, the formula becomes

$V=E-P=E-(IR.\cos\varphi+IX.\sin\varphi)$†
for lagging power factors .....(7)

As a second approximation

$$V=E-P-\frac{Q^2}{2.E} \quad .....(8)$$

which is used in the calculation of transformer regulation.

Regulation from the Nomogram

Formula (7) can be rewritten as
Voltage drop

$$=IR.\cos\varphi+IX.\sin\varphi=IR(\cos\varphi+\frac{X}{R}\sin\varphi)$$

= (IR drop from nomogram) x (factor given in Table II) .....(9)

TABLE II.—Values of Cos $\varphi+\frac{X}{R}$ sin φ

Cable Section sq. inches	Power Factor—lagging			
	0·9	0·8	0·7	0·6
0·5	1·43	1·53	1·57	1·58
0·4	1·34	1·40	1·42	1·40
0·3	1·23	1·25	1·24	1·20
0·25	1·17	1·17	1·14	1·10
0·2	1·12	1·10	1·05	1·00
0·15	1·06	1·03	0·97	0·90
0·1	1·02	0·96	0·89	0·82
0·06	0·97	0·90	0·82	0·73
0·04	0·95	0·87	0·78	0·69
0·0225	0·93	0·84	0·75	0·66

Note: Applicable to B.S. cables, 660 V 3- or 4-core at 50 c/s.

The selection of a suitable l.v. paper-insulated cable, for a given duty, is easily made with the aid of the nomogram, as the essential information is determined from the intersection of a straight line and the scales. Reading from bottom to top, the scales give:—

(*a*) Three-phase load in kVA at 415/240 V.
(*b*) Line current in amps for a balanced load, equal to (a).
(*c*) Copper losses in kW/1,000 yards at 60° F.
(*d*) Basic E.R.A. current ratings for standard conditions of laying.
(*e*) Voltage drop IR per 1,000 yards at 60° F.
(*f*) Nominal area of B.S. conductor.
(*g*) Resistance maximum ohms per 1,000 yards at 60° F.

Should regulation by calculation be required, formula (7) can be rewritten as:

$$\text{Voltage drop}=\frac{2\cdot5}{A}(\cos\varphi+2\cdot5A\sin\varphi)$$

volts/100 amps/1,000 yds.....(10)

This convenient form is obtained by letting $R=\frac{0\cdot025}{A}$ and X=0·0625 ohms/1,000 yards.

3-phase 4-wire Unbalanced Load

In addition to the voltage drop in the phase conductor, there is now a drop in the neutral wire; or, in other words, a displacement of the neutral point, which appears as a rise or fall of the line to neutral voltage, according to which phase is considered.

The case of the three phases loaded unequally, with loads of different power factors, is of considerable theoretical interest; but this general case will not result in a simple solution. Simplifying assumptions will have to be made.

Assume that the line currents are at equal power factors (phase angles) to their respective phase voltages. For this special case, the concept of power factor of an unbalanced system presents no difficulty.

Taking I_a as the reference vector, then: I_a; $I_b(-\frac{1}{2}-j0\cdot866)$; $I_c(-\frac{1}{2}+j0\cdot866)$ are the line currents, neglecting the small phase displacements due to the regulation. The neutral current $I_o=I_a+I_b+I_c$....(11), see Fig. 1. And the voltage drop due to the neutral current is, nearly, the in-phase component of $I_o.Z_o$, i.e. the real part of $I_o.Z_o$ when referred to the phase under consideration.

$I_o.Z_o=(I_a+I_b+I_c)(R+jX)(\cos\varphi-j\sin\varphi)$ (12)
shifting the reference vector to V_a.

Voltage drop in neutral wire = Real Part of
$I_o.Z_o=(I_a-\frac{1}{2}I_b-\frac{1}{2}I_c)(R\cos\varphi+X\sin\varphi)$
$+0\cdot866(I_b-I_c)(X\cos\varphi-R\sin\varphi)$..(13)

Neglecting the second term of this expression (0·866, etc.) as insignificant in many cases, and taking into account the voltage drop in the phase conductor, we have finally:

Voltage drop phase A to neutral =
$(2I_a-\frac{1}{2}I_b-\frac{1}{2}I_c)(R\cos\varphi+X\sin\varphi)$..(14)

By comparing this formula with (7), it is easily seen that, for unbalanced loads, we enter the nomogram with $2I_a-\frac{1}{2}I_b-\frac{1}{2}I_c$ instead of I_a, and then multiply by the factor in Table II. For half section neutral, where the resistance of the neutral core is 2R, and the reactance is unchanged, the formula becomes:

Voltage drop phase A to neutral
$=(3I_a-I_b-I_c)R.\cos\varphi$
$+(2I_a-\frac{1}{2}I_b-\frac{1}{2}I_c)X\sin\varphi$ .....(15)

These formulae should not be used where the basic assumption of equal power factors does not hold, e.g. line-to-line single-phase welding loads. Furthermore, the neglected term in (13) may be of some importance; this term is dependent on the phase rotation, and its neglect results in formulae which are independent of the phase rotation. The phase to neutral

voltages of phases B and C are obtained by cyclic interchange of the suffixes in the formulae.

An Example

Find the phase-to-neutral voltage drops, when loads of $I_a = 120a$, $I_b = 60a$, $I_c = 30a$ at 0·9 p.f. lagging, are supplied via 1,000 yards of 0·3 sq in. 4-core.

The balanced voltage drop with 120 amps per phase is equal to (10 V from nomogram) (1·23 from Table II) = 12·3 V.

Or by formula (10), voltage drop =

$$\frac{120}{100} \times \frac{2 \cdot 5}{0 \cdot 3} (0 \cdot 9 + 2 \cdot 5 \times 0 \cdot 3 \times 0 \cdot 436)$$

$$= 10\,(0 \cdot 9 + 0 \cdot 33) = 12 \cdot 3 \text{ V as before.}$$

The unbalanced voltage drops are obtained as follows:—

$2I_a - \frac{1}{2}I_b - \frac{1}{2}I_c = 240 - 30 - 15 = 195$ amps.

$2I_b - \frac{1}{2}I_a - \frac{1}{2}I_c = 120 - 60 - 15 = 45$ amps.

$2I_c - \frac{1}{2}I_a - \frac{1}{2}I_b = 60 - 60 - 30 = -30$ amps.

Therefore

$$\text{Voltage Drop A} = \frac{195}{120} \times 12 \cdot 3 = 20 \cdot 0 \text{ volts}$$

$$\text{Voltage Drop B} = \frac{45}{120} \times 12 \cdot 3 = 4 \cdot 6 \text{ volts}$$

$$\text{Voltage Drop C} = \frac{-30}{120} \times 12 \cdot 3 = -3 \cdot 1 \text{ volts,}$$

i.e. a rise.

The neglected term in (13) has the following values: phase A = 0·5 V; phase B = −1·6 V; phase C = 1·0 V.

---

*Paper insulated cables manufactured to B.S. 480 : 1942 660-volt class, operating at 50 c/s, are denoted. Especially multi-core on three-phase four-wire systems.

†This formula is sufficiently accurate for practical regulation calculation; it is doubtful whether accuracy of a higher order is worth pursuing.

Our readers' views . . .

Engineers Wanted

WHILST welcoming the support of your Yorkshire correspondent, "Articled Apprentice of thirty years ago," I ask your indulgence to re-state my attitude to the questions raised under this heading, because there appears to be some misunderstanding concerning the purport of my previous letter.

I wish to see neither legislation restricting the employment of "unqualified engineers," nor yet any "weeding-out" of qualified engineers who have had no occasion to pass professional or academic examinations.

My principal contention is that the best man should be chosen for a given vacancy irrespective of his academic or professional qualification. Clearly, those in possession of such appropriate qualifications will be most likely to have gained the experience required and will, therefore, often stand the best chance of being selected, but it must be the qualities of the candidate at the time of his application which determine the choice, and not the fact that he achieved certain accepted general standards of proficiency in the distant past. Academic and professional qualifications alone do not necessarily qualify an engineer for a particular vacancy, but rather does the use to which these advantages have been put.

Also, quite apart from these considerations, a country struggling to maintain its place as a leading exporter of manufactured goods and endeavouring further to develop its own agriculture while being forced to intensify its military defence, cannot afford a "select club" attitude towards the practice of engineering technology in any branch of industry.

W. H. Campbell
A.M.I.E.E.

BRISTOL

Moot Points in Production

THE operator who veils his identity under the signature of "*j*" in your last issue, does not appear to have a great deal of confidence in his own capabilities if he is not prepared to take the responsibility of deciding whether or not to shut down his machines on unbalanced loading. I agree with the authors of the paper in question that negative phase sequence *indication* is preferable to n.p.s. *protection*, in that it does give one at least a chance to try and clear the trouble without shutting down the machines. Continuity of supply has, admittedly, lost much of its meaning as far as the general public is concerned, but to the conscientious operating engineer it is still an article of faith.

Ninety seconds is not a long time, admittedly, but it is long enough in these days of speed to win or lose a battle, let alone to make up one's mind. At least, let us have a chance to try, instead of insisting upon being spoon-fed. I speak for myself, but it would be interesting to have opinions from other engineers.

"Independent"

LONDON

Another Look at the FESTIVAL Celebrations

SCIENCE AT SOUTH KENSINGTON HIGHLIGHTS ATOM AND NUCLEUS

REMARKABLE as it is, the present South Bank Exhibition is by no means the whole of the Festival of Britain, and an article such as that we published last week must miss many interesting features to be seen elsewhere in London and the provinces. Undoubtedly the first of these at present is the Exhibition of Science at South Kensington, which is housed in an extension of the well-known Science Museum. It may be desirable, in view of the close physical connection, to note that the museum had no direct responsibility for the planning of the Festival display.

Larger View

At the very beginning, the Exhibition of Science plunges the visitor into a sub-microscopic world, for the entrance corridor is walled to suggest first the molecular and then the nuclear composition of a graphite rod, seen in ever-increasing order of magnification, up to 10^{10} times actual size. This concentration on the atom is continued in the exhibition proper, for a display of the elements set out in order introduces sections on nuclear structure and chemical and physical make-up. Full use is made of electronic techniques to demonstrate the points made in the captions to the various exhibits, and the latter include many examples of research apparatus used by the scientists who made the first great strides in the study of the sub-atomic world.

The next section in the exhibition is entitled "Structure and Mechanism of Life," and can claim no special review here, but matters of direct electrical interest are well to the fore in the final display, "Stop Press." This seeks to show some of the latest lines of thought in science, and to relate them to the ideas developed earlier in the exhibition. The study of cosmic rays and of luminescence provide obvious examples of electrical interest, but outstanding is the "electronic brain"—digital computor, to be more correct—which will relentlessly play a game of skill against all comers, winning if they make even one mistake. A Ferranti development, the machine has been named "Nimrod," after the game it plays so successfully.

Something of the story unfolded in the Festival Exhibition is adequately continued in a gallery at the top of the Science Museum. Here interested visitors may study photographs of nuclear fission and see some more of the classic apparatus developed at the Cavendish laboratory. If they come from outside London, they will be well rewarded for examining the museum collections generally, and if electrical engineering be their interest there are four sections they should seek out particularly—those dealing with electrical power engineering and with radio (first floor), with electronics, photo-electricity and related phenomena (top floor), and with the history and theory of illumination (basement). Some of these displays, particularly the last, show that the techniques applied throughout the Festival exhibitions were already known in the world of museums.

Festival Gardens

A section of the Festival arrangements that has had some unfavourable publicity is the Festival Gardens project in Battersea Park. Details of the electrical arrangements for the installation there have recently been described by A. H. Barker and Partners, who acted as electrical consultants.

Two main points of supply are provided by the London Electricity Board, one at 11 kV feeding a ring of five transformer chambers at the eastern end of the Gardens, and another ring at 6·6 kV supplying three chambers at the western end. The chambers are standard 500 kVA units, though three of them are double units, and follow in general the plan described in the ELECTRICAL TIMES of 19th April, 1951.

Secondary distribution is carried out mainly at 240 V three-phase, in p.i.l.c. & s. cable, laid direct in the ground or, where possible, through buildings. In many cases the feeders are looped in and out of several supply points. Final sub-circuits are nearly always in t.r.s. v.i.r. cable, with an included earth wire. Feeds to

the majority of outside lighting fittings are also in t.r.s., through the trees, on the tops of buildings, or laid direct in the ground. The deciding factor leading to the choice of t.r.s. was the limitation of the opening life of the Gardens to six months, combined with ease of handling and availability.

A wide variety of public lighting has been provided for the Gardens, and no generalised description is possible. Care has been taken to avoid a complete blackout by the provision of an emergency installation supplied by an oil engine-driven generator.

Apart from the electrical consultants already mentioned, the principal organisations involved in electrical work at Battersea were the London Electricity Board for h.v. work, Messrs. Drake and Gorham for secondary wiring at the west end, and Messrs. Barlow and Young at the east end.

Land Travel Exhibition

First view of the Land Travelling Exhibition which opened in Manchester on Friday should satisfy expectant visitors. The 120 ft long by 50 ft high facade houses 21 ex-naval searchlights, each of some 750,000 candlepower. The beams are directed upwards to give a glow in the sky which is visible for miles away.

The exhibition proper is divided into six sections, with the following themes: materials and skill, invention, discovery and design, people at work, people at home, people at play, and people at travel. The first of these is largely introductory and historical in nature, but "invention, discovery and design" does introduce two sections of direct electrical interest. The first of these is a lighting display, showing the various types of electrically-powered light source available, and the second, "domestic equipment," includes a demonstration of how the domestic flat-iron has developed from the flame-heated solid design to the latest type of electric rotary iron.

"People at home" is largely concerned with furnishings, but one of the special problems treated is, how to thus incorporate a television receiver in the living room, while the next section, "People at work," naturally has more exhibits of engineering interest—with the accent on the gas turbine.

The Land Travelling Exhibition will be open in Manchester (City Hall, Deansgate) from May 5 to 26, then at Leeds (Woodhouse Moor), June 23 to July 14, at Birmingham (Bingley Hall, King Alfred's Place), August 4 to 25, and at Nottingham (Broad Marsh), September 15 to October 6.

European Supply Co-operation

MUCH useful international work is done by committees of UNESCO, and this is specially true of the Committee on Electric Power, which recently reported to the Economic Commission of Europe on its activities during the year ended March, 1951. There is a topical note in this document when it mentions the shortage of raw materials, e.g. transformer sheets, as inhibiting a satisfactory rate of electrical machinery production. On the whole, though, the conclusion is reached that the production capacity of plants manufacturing materials for electrical machinery is sufficient to meet European needs.

Various power interchange schemes have been investigated, and special attention has been paid to energy lost as "overflow" in hydro schemes in various countries. It was found that 0·3% and 0·15% of total generation was lost in this way in 1948 and 1949 respectively, and the losses, due to either under-consumption or inadequate transmission network capacity, occurred during off-peak periods and simultaneously in the various countries. They would not justify the establishment of new interconnection lines.

Legal questions have been considered by a Group of Experts set up by the Committee. Specific studies have dealt with legislation covering the interchange of electrical energy across national frontiers, and with problems raised by the hydro-electric development of rivers of common interest. The comparatively simple case where a river constitutes the frontier between two or more states is being intensively studied with a view to the simplification of present administrative formalities.

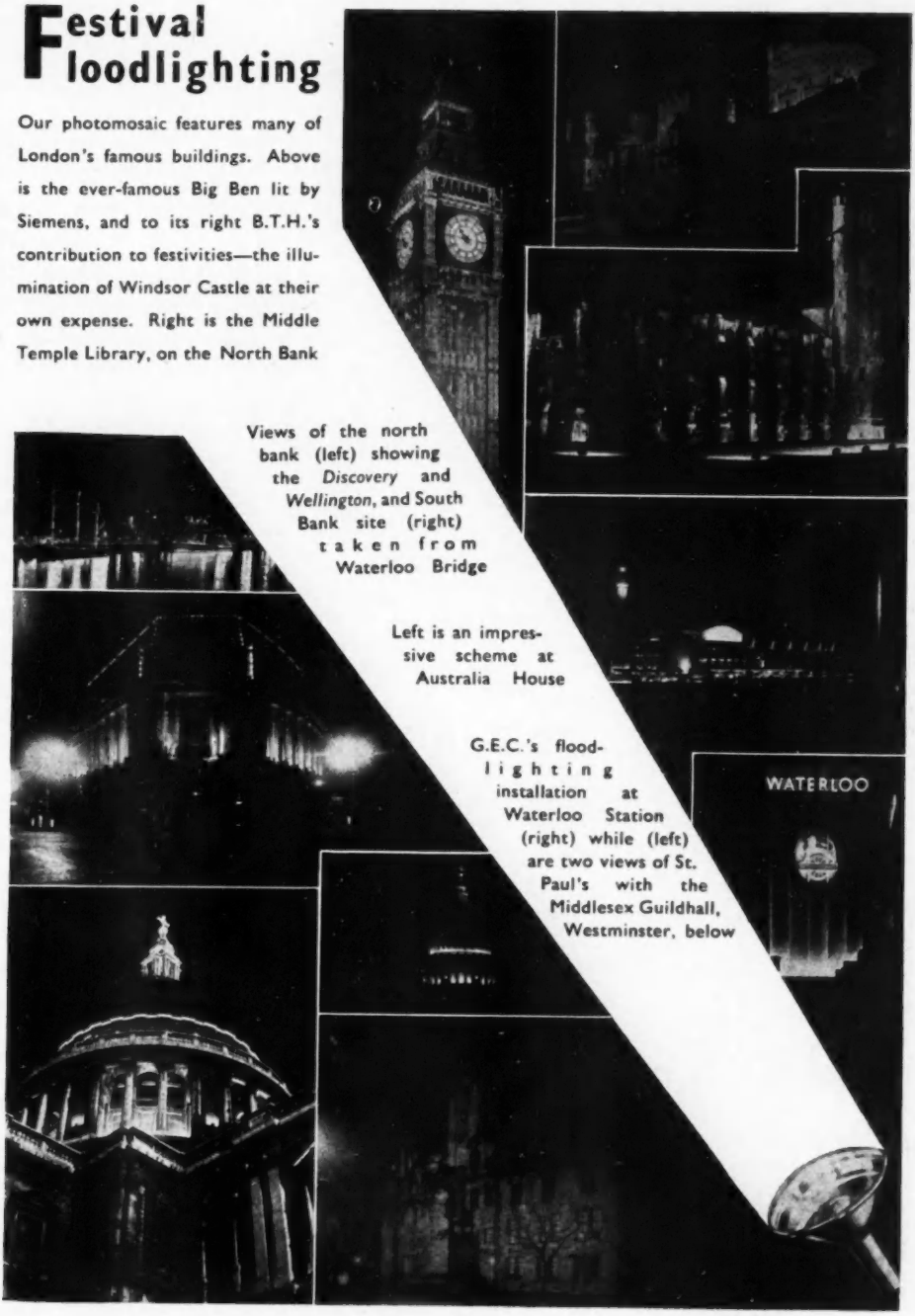
Liaison and Organisation

Close collaboration has been sought with existing non-government organisations in the field of electric power, with the purpose of avoiding overlapping of opportunities. Such collaboration has been most notable with UNIPED (International Union of Producers and Distributors of Electric Power): periodical statistics published by this body are to be used as a basis for Committee purposes.

The organisation of the Committee on Electric Power has been based on a liaison group consisting of the Committee's chairman and vice-chairman; and the chairmen of four permanent working parties. These working parties dealt respectively with problems of thermal power, hydro-electric power, interconnections and statistics. *Ad hoc* "Groups of Experts" are set up side by side with the working parties to deal with special problems.

Festival floodlighting

Our photomosaic features many of London's famous buildings. Above is the ever-famous Big Ben lit by Siemens, and to its right B.T.H.'s contribution to festivities—the illumination of Windsor Castle at their own expense. Right is the Middle Temple Library, on the North Bank



Views of the north bank (left) showing the *Discovery* and *Wellington*, and South Bank site (right) taken from Waterloo Bridge

Left is an impressive scheme at Australia House

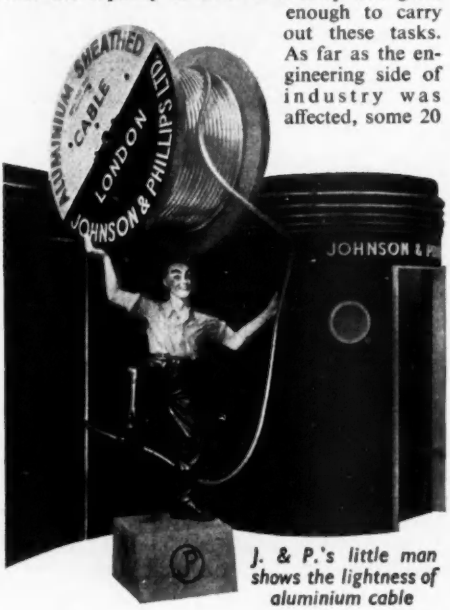
G.E.C.'s floodlighting installation at Waterloo Station (right) while (left) are two views of St. Paul's with the Middlesex Guildhall, Westminster, below

BIF - *Some impressions at Castle Bromwich*

WE have already had occasion to comment on the probable trends of this year's British Industries Fair as far as the Electrical Section at Castle Bromwich is concerned. The first week's experience has to a large extent borne out our estimates. Generally, the attendance was well down compared with last year. Buyers, particularly of luxury or semi-luxury goods, found a marked reluctance on the part of some sellers to accept orders—probably because of raw material uncertainty—and business in larger items was quiet. Apart, however, from the purely trading aspect, the electrical section is well worth visiting despite the comparative lack of new items.

H.R.H. Princess Margaret visited the Exhibition last Wednesday. She is seen here in the outdoor section

The difficulties facing the manufacturer were well defined by Sir Hartley Shawcross, President of the Board of Trade, at the Mansion House dinner when he pointed out that the country had to rearm for defence, build up exports to still greater proportions and still maintain the standard of living of the people. Providing materials were forthcoming in sufficient quantity, he was confident that the capacity of British industry was great enough to carry out these tasks. As far as the engineering side of industry was affected, some 20 to 25% of capacity would be absorbed by defence requirements.



J. & P.'s little man shows the lightness of aluminium cable

Some comments on Sir Hartley's speech were made by Mr. T. Lister, Chairman of the B.E.A.M.A., at the luncheon given by the Birmingham Chamber of Commerce. Whilst he was sure that Sir Hartley was genuine in his desire to help manufacturers, the existence of bulk buying and bulk selling involved trade in politics. He thought it was impossible that bulk buying could be a success. Great Britain had not been built up on controls but on a system of free enterprise. In connection with trading difficulties he specifically mentioned the stranglehold being exercised by the dockers on the shipping of the world.

He further urged on manufacturers the necessity of supporting the electrical industry in convincing the Government departments and the Treasury of the need for increased generating capacity. Exports were the life blood of the country and unless electricity was available, production would suffer.

On Wednesday of last week the Fair was honoured by the visit of H.R.H. Princess Margaret who spent some two hours at Castle Bromwich, visiting stands and taking a great interest in the exhibits, particularly in the engineering section.

Fair Impressions

Reverting to the Fair proper, one of the points striking the observer is the extensive use of models and photographic reproductions to illustrate the products of the heavier electrical engineering com-

Above and on the right are the Brush and Chloride stands. Below right is Venner's display, and at the bottom of the page is Crompton Parkinsons' stand

panies. This is a development of considerable value, as the extent and size of many large engineering projects can only be judged by these means. On G.E.C.'s stand, for example, there is an excellent cut-out photographic reproduction of a power station turbine room. Viewed from one angle, in fact, the display takes on very nearly three-dimensional properties. Material handling equipment on this stand is well illustrated by a delightful working model of a Fraser and Chalmers-Marshall waggon-tippler.

Metropolitan-Vickers have a model of one of the largest colliery winders yet designed. This skip winder has a skip capacity of 12 tons with an output of 500 tons/hr. Peak duty is 18,000 h.p., and Ward Leonard-Ilgner control is used. English Electric have three power station models: one of a large B.E.A. station, one of a 4,925 kW diesel-powered station, and lastly an excellent sectioned model of one of the large water-turbine electric units built for the Castelo do Bode station in Portugal. All the models are excellently made and finished, and incidentally in themselves form an excellent example of British craftsmanship.

Two interesting animated diagrams are on view. One, by John Thompson Ltd., shows the operation of an "Etaflo" steam generator as used in large power stations; the other, on the Metropolitan-Vickers stand, illustrates the method of operation of the sequence interlocking control as applied to multiple-unit conveyor systems.

Heavy Plant Exhibits

The Electrical Section is particularly rich in exhibits representative of heavy machinery and plant. For some reason, most of the large concerns decided to make a special display of switchgear. Among the larger items are two 1,500 MVA rupturing capacity 33 kV units on G.E.C. and Reyrolle's stands. The coincidence of these two items affords buyers an opportunity to contrast the two manufacturers' techniques. Another large unit is the 750 MVA 33 kV type VSLP 10/IVS ring main unit shown by Ferguson Pailin. Smaller items of switchgear are being shown by B.T.H., Metrovick, Brush, Crompton Parkinson, Electric Construction Co., English Electric,

Electro Mechanical Mfg. Co. and Yorkshire Switchgear and Engineering Co.

Among other eye-catching items are the top half of the stator of a 2,280 kVA, 6·6 kV alternator shown by the Electric Construction Co.; a short shaft carrying h.p. and l.p. blading from a large turbine shown by the G.E.C.; the 66 kV open-type small-oil-volume circuit breaker on Reyrolle's stand, and the large moulding presses operating on B.I.P.'s stand. An impressive item being exhibited by Ferranti is a full-sized rotary on-load tap changing gear arranged for remote control with electrical operation and a remote tap position indicator. This unit is suitable for all sizes of transformer over 5,000 kVA. The same firm is also showing one of the Ferranti automatic moving coil voltage regulators connected to correct variations in the supply mains. Incidentally, at the time we inspected this exhibit,

it was having an easy time as the mains supply seemed to be singularly steady.

Motors and Light Plant

As ever, the Higgs' stand showed impressively the range of motors manufactured by this well-known firm. Fractional h.p. motors were also on view at the Hoovers' stand, and Newton Bros. of Derby were again showing their remarkable range of specialised equipment used mainly for providing power supplies at high frequency or at special voltages for aircraft and ships radio and radar installations. At the E.C.C. stand is a G.P.O. ringing machine which shows how "busy," "ringing," "dialling" and "number unobtainable" are all obtained from one machine. Brook Motors have specifically catered for the overseas market by the production of their BREMA range. Nearly all the big manufacturers make motors varying in size from f.h.p. units up to machines capable of producing several thousand h.p., and most of these firms show a small number of motors, mostly specialised, to illustrate their work in this line.

Although its prominence is not so noticeable this year, electronic control of motor drives is still of great importance in industry. One of the B.T.H. items shows a section of the control equipment for a 12-unit newspaper printing press, using Ignitrons to produce a controlled d.c. voltage to supply the various motors. E.C.C. are showing a controlled drive using a grid-controlled rectifier as the regulating agent.

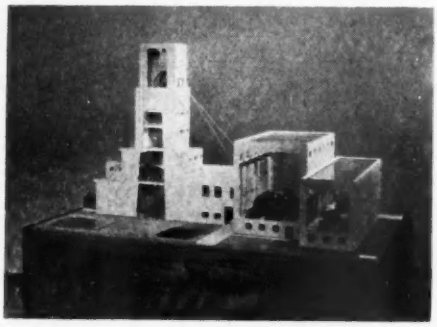
Domestic Equipment

As we mentioned before, many of the cooker and washing machine manufacturers are not exhibiting this year. Only three firms in fact are showing cookers. These are the English Electric Co., British National Electrics and Gillott Electro-Steam Cookers Ltd. An unusual item in this line, however, is the heat storage cooker being shown on the joint E.D.A. and Midlands Electricity Board stand. As far as washing machines are concerned, however, quite a representative selection of makes are available, although in the majority of cases the items being shown are similar to those on view last year. Bendix, however, have redesigned their fully automatic model, and H. Fisher (Oldham) are demonstrating the assembly of their machine using the "Meccano" technique.

For markets overseas are the two models being shown for the first time by Wilkins and Mitchell. The square cabinet type "M" is specifically designed for the Canadian market, and the round model "R," intended for home or overseas, can be supplied with heating elements and pump.

Fires are being shown by Ferranti Ltd. who have on view their "Safera" model, and Berry's Electric Ltd., have introduced their "Vanguard"

E.C.C.'s stand, left, shows the top half of a 2,280 KVA 6·6 KV alternator stator, and below, this model of Metrovick's skip winder represents the largest installation yet made in Britain



reflector model rated at 2 kW. Both these fires concentrate on the safety aspect. L. G. Hawkins are showing their re-designed, 1,500 watt "Sunray" model.

Water heaters and heating elements are available in some numbers, although again some well-known firms are not showing this year. Campbell Engineering have an "instantaneous" type water heater in 5 kW and 3 kW models. These are so designed that they are switched on by the action of the flowing water. Johnson and Phillips have a new immersion heater, and for canteens and places where a copious hot water supply is required, is a thermal storage heater of 75 gallons capacity made by Berry's Electric Ltd.

Refrigerators are being shown by Fleming Components Ltd., who have introduced on to the domestic market the MAK 7½ cu ft model (primarily for export) and a 4½ cu ft utility model.

Accessories

A great number of accessories are to be seen. Barrie's Electrical Agencies and Metway Electrical Industries Ltd. are showing an extensive range of replacement elements for electric fires and irons, and are making a special feature this Festival year of floodlighting equipment. Lampholders and lighting fittings in great profusion adorn the stand of William McGeoch and Co., and lighting fittings, particularly of the decorative and artistic variety, are also featured by Berry's

Electric Ltd. and Falk Stadelmann and Co. Tumbler switches, control switches, socket boxes and socket outlets are shown by New Day Electrical Accessories and also by Nettle Accessories.

Both the welding and direct electric heating exhibits are less in number than in former years. Sciaky have remodelled their three-phase spot welder and Siemens Schuckert (Gt. Britain) Ltd., have produced a small bench spot-welder for fine wire work. Stud welding equipment was being displayed by Cyc-Arc Ltd.

Industrial heating furnaces operated electrically are virtually absent from the show this year, the furnace makers concentrating on other branches of production. Induction heating is also little represented, only four firms showing this type of equipment. Radio Heaters had a working example showing the hardening of ratchet pawls, and Applied High Frequency Ltd. are showing a 7½ kW general-purpose model. Other firms in this field are the Incandescent Group and Metalectric Furnaces Ltd.

Measuring R.R.R.V.

Belgian Engineer Lectures to I.E.E. Measurements Section

INFORMATION on the rate of rise of restriking voltage to be expected when an h.v. power circuit is opened is of great value to switchgear design and testing engineers. There was, therefore, general interest in a lecture which Professor P. Fourmarier presented to the I.E.E. Measurements Section last week, under the title "The Measurement of Natural Frequencies of Power Networks."

Professor Fourmarier first considered the possibilities of calculating natural frequency, and showed that these are severely limited because of the general complexity of modern networks, combined with difficulties introduced when distributed parameters are replaced by lumped capacitances and inductances. However, assuming an "ideal" circuit-breaker, and adopting the superposition idea of representing breaker opening by switching in a generator whose e.m.f. would give a current equal and opposite to that flowing at a given instant, equations are obtained which form the basis of one method of measurement.

Off-Load Measurements

This can only be applied with the network out of service, and involves feeding the network from a variable frequency sine-wave generator, and measuring the r.m.s. input voltage and current. It has the advantages of good accuracy, independent of the circuit-breaker, but the experimental procedure is rather delicate. An "injection current method," developed in Great Britain, uses a thyratron to control a linearly changing current injected into the circuit being measured at 50 c/s. The shape of the resulting waveform gives the information required for the determination of natural frequencies.

Two further methods have been developed for application to networks while they are in operation. The first applies the fundamental idea of connecting, in the line under investigation, an auxiliary circuit. This is then switched out, by an auxiliary c.b., and the resulting oscillations recorded on a c.r.o. While the method is very attractive in that it does not prevent the use of the circuit being tested, it has the great disadvantage that the auxiliary load (usually an inductor) must have a current capacity of 9% at least of the short circuit MVA. Such a piece of equipment is, of course, extremely expensive.

C.R.O. Compensation

Professor Fourmarier himself has independently developed a somewhat similar method, and this he described in some detail. The basis is that if any load on a single-phase line is switched off by a circuit-breaker, a restriking voltage is developed at the c.b. terminals which is proportional to the current broken. In principle, the line itself can be used as the load to be switched, but the resultant jump of voltage is small, and difficult to measure, if the c.r.o. is recording the full waveform of the voltage. Some improvement is possible if a compensating circuit is used to control the operation of the c.r.o.

Such a circuit has been developed, in spite of some fundamental difficulties due to the effect of harmonics, and to the mutual influence of high voltage on low voltage through the feeding transformer. To obtain the best results, too, a special time-base circuit had to be developed, so that a full record of restriking voltages could be obtained up to frequencies of several kc/s.

In concluding his lecture, Professor Fourmarier gave a brief summary of some tests carried out on the Belgian networks. The principle of the method was checked on a 14 MVA, 6·6 kV generator at Bressoux. Short circuit and reduced current tests were made,

and in the former the machine was connected to two miles of cable, the ends of which were short-circuited. In this test the machine was operated at 2 kV, and the average value of frequency of restriking voltage was found to be 23·9 kc/s. With the machine on normal load, suddenly switched off by its protecting breaker, the average value of frequency was found to be 21·7 kc/s. The 9% discrepancy is considered reasonable in view of the different conditions of saturation.

Network tests were then made at four points on the Belgian 70 kV network. The general scheme was to connect the c.r.o. and the line to be switched out to one substation busbar, and the rest of the network to the other. By opening the line c.b., the restriking voltage of the substation was recorded, and by opening the interbus c.b., the line restriking voltage was measured.

The method could be extended to determine the short-circuit current at a given point in a network, basing this on the ratio of service voltage to network impedance as seen from that point. A value for the impedance is given by the voltage increase measured in the tests described above. So far, however, this technique has not been applied.

In conclusion, the lecturer attempted to balance up the practical value of the various methods which he had described. He suggested that if the network can be taken off load, the injected current method is by far the simplest; otherwise his own offered most advantages.

HIGH POWER FUSES ARE REWIREABLE

Time lag characteristics retained in new Aeroflex designs

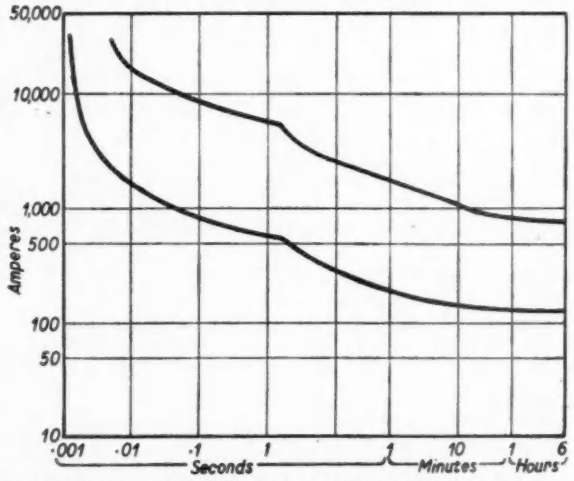
HIGH breaking capacity fuses with rewiring facilities and low fusing factors are now available in the Parmiter Hope and Sugden, Ltd., range in dimensions that make them suitable for link and distribution boxes.

As with previous fuses in the Aeroflex range, the fuses embody a composite fuse element, which consists of a double silver strip, necked to control melting under short-circuit conditions. At the centre of the element is a fluxed capsule of low melting point alloy, which interrupts the circuit on sustained overload and provides the low fusing factor (ratio of minimum fusing current to rated current) which is a feature of Aeroflex designs. The two part construction of the elements results in a discontinuity of slope in the fusing characteristics, as shown in the diagram, and the time lag at currents up to about 100 times rated current are greater than with conventional elements, a feature which is of value in permitting temporary surges on a circuit without fuses operating.

Rewiring

Fuses in this "Ceram" range have a cylindrical ceramic body, pierced to give hollow cylinders in which the elements are carried. A metal end cap is fitted over each end of the fuse body and the tails of the element are slipped through slots in this. A removable outer end-cap carrying the fuse contacts is finally soldered on and the fuse is ready for use. When a fuse has operated, it can be returned to the works, where a new set of fuse elements is fitted. The charge for this service is far below that for new cartridges.

Fuses are provided with a readily visible indicator which shows the state of the elements. They are available in ratings up to 1,000 amps for short-circuit duty to category 440 AC4 (25 MVA breaking capacity) of BS 88 : 1947. Various designs of contact are available.



Fusing characterists for 600 amp and 100 amp fuse links are shown

B.T.H. Research in 1950

A brief resume of some of the work being carried out at the Laboratories at Rugby

THE following short notes may be of interest in giving an idea of some of the research lines which have been pursued at the B.T.H. Laboratories over the past year. Broadly, the work falls under the two headings of Materials, and Devices and Processes, although a considerable overlap inevitably occurs.

Magnetic Sheet Steel

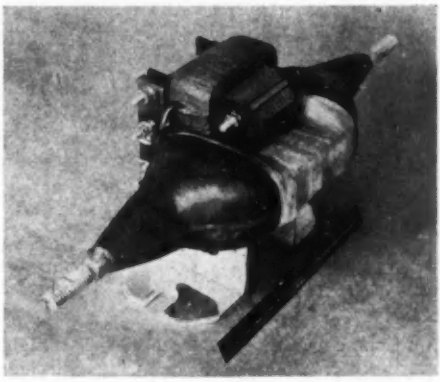
In common with many other laboratories, work has been carried on in the study of the properties of magnetic sheet steel. Progress has been made in the methods used for determining crystal orientation in sheet steel, both optical and X-ray diffraction methods now being firmly established. It has been found possible to reduce the carbon content of silicon iron sheet from 0·03 to 0·005% in a short time, and by suitable annealing treatment to develop crystals of large size (up to several inches long) with a corresponding improvement in the magnetic properties.

A special induction furnace, designed to operate under vacuum conditions, or with controlled atmospheres of high or low pressure, suitable for the melting of small metal ingots has been built. This is powered by a B.T.H. h.f. generator rated at 10 kW at 400 kc/s. The vacuum system itself consists of a vacuum chamber (a silica tube 4 in. dia. and 20 in. long) connected to an oil diffusion pump rated at 400 litres/sec, with baffle valve and associated equipment.

Metal Research

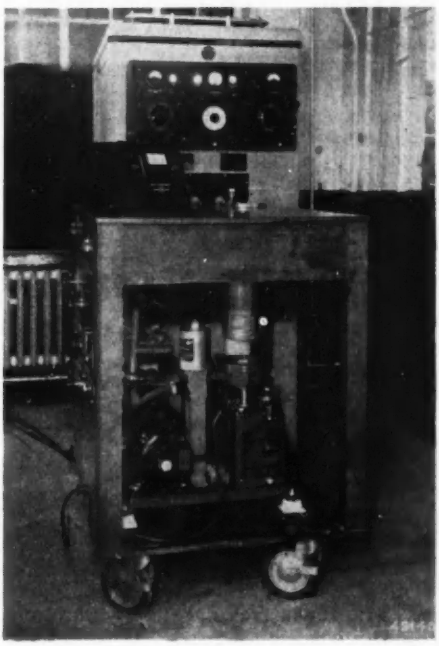
Blading and bolting materials for gas and steam turbines are being tested at the stresses and temperatures under which they will operate in practice, and the relaxation property of molybdenum-vanadium steel has been determined by simulating the daily stress cycle resulting from the cooling and reheating of the turbine.

An apparatus has been constructed for examining high temperature steam corrosion of metals. Good corrosion resistance must be complementary to creep resist in steam turbines operating at higher temperatures, and it is desirable that the scale formed should be adherent to the metal and thus help to protect it from oxidation. Small cylindrical specimens are subjected to heating and cooling in an



High-voltage current transformer insulated with synthetic rubber

Induction furnace designed to operate under vacuum or controlled atmospheres at high and low pressures



Mass Spectrometer leak detector developed at Rugby

atmosphere of nitrogen, and while at high temperature, a steady stream of superheated steam passes over the metallic surfaces. At the conclusion of the test, measurement is made of the extent of corrosion and the degree of adherence of the oxide scale.

Insulation

In the constant search for new and improved insulating materials, some special attention has been given to the possibilities of synthetic rubber, solventless varnishes and bitumen bonded micafolium for stator coil insulation.

A gasket material for oil-tight joints for transformers, which can be used repeatedly and is resistant to transformer oil, has long been a requirement in transformer manufacture, and promising results have been obtained with nitrile rubber; long-term ageing tests have been put in hand to confirm preliminary laboratory tests.

Another application of synthetic rubber is to the insulation of high voltage current transformers. This material, a mixture of polyisobutylene and isoprene, has been used for a moulded covering for current transformer coils instead of the standard method of taping with high quality varnished cloth tapes. Several of these coils have now been moulded and have satisfactorily withstood the high voltage tests.

Equipment Research

The ignitron switch for use with the 300-MeV synchrotron for Glasgow University has now been completed. The operation of the synchrotron requires an increasing magnetic field; this is obtained by allowing a bank of condensers to discharge into the synchrotron magnet through the switch.

The condenser and magnet are allowed to oscillate for one complete cycle so that at the end of the period the voltage of the condensers is restored to its original polarity. Consequently, only the energy corresponding to the copper loss in the electrical circuit and the iron loss in the magnet has to be supplied by the rectifier.

Rating of the switch is 5,000 amps peak at 20 kV; the natural frequency of the condensers and magnet is about 50 c/s and the switch operates five times per sec.

Eight ignitrons are employed in the switch; four in parallel to pass the positive half-cycle of current and four to pass the negative half-cycle. The ignitrons used are BK. 56's, 3 ft 6 in. high and 9 in. dia. with a water-cooled, steel envelope.

The laboratory has been studying phosphors for television cathode ray projection tubes, and two experimental projection receivers have been built, one giving a 16 in. by 12 in. picture and the other a 20 in. by 15 in. picture.

High Voltage Equipment

Erection of a two-million-volt impulse generator, designed in the laboratory, has begun in the heavy plant factory. The generator consists of four 30 ft columns, each comprising seven 0.2 mfd capacitors, rated for a d.c. charging voltage of 100 kV and separated by Paxolin spacer tubes. These columns are mounted on a 10 ft high platform, beneath which are housed the high voltage charging transformer and rectifier valve. The bun-shaped electrode, which forms the output terminal of the generator, will thus be some 40 ft above ground level. A maximum charged energy of 28,000 joules will be the capacity of the generator.

Other Research

The electrolytic bath method of plotting potential gradients has proved of great value in inductor alternator design in showing the influence of core slot shapes on the alternator behaviour.

Work has also continued on the development of an alternative seal through quartz capable of passing large currents in connection with the design of high current lamps. This seal is particularly useful for the development work which is going on in trying to produce a practical light source out of the high pressure Xenon discharge.

A special lamp for Raman Spectroscopy has been developed, giving a high intensity of 4,358 A radiation, and work has also continued on filament lamp ballasts for fluorescent lamps and on the methods of dimming hot cathode lamps.

Problems and Practice

IN ENGINEERING

Hot Bearings

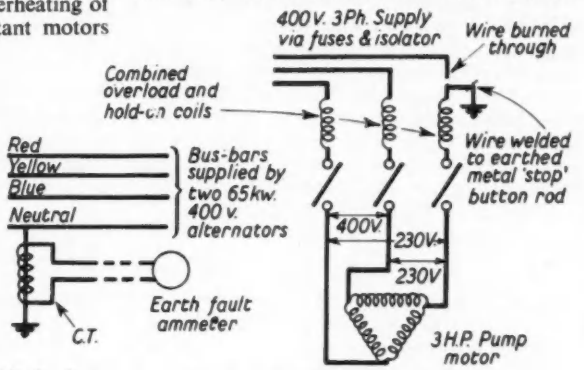
SMALL motors fitted with oil-less bushes, and the wide range of machines fitted with ball and roller bearings, give little bearing trouble when properly maintained. Large motors fitted with plain ring-oiled bearings require rather more attention. Overheating of the bearings on large and important motors can prove very costly. The bearings of large motors running fully loaded can sometimes be very temperamental, a sudden increase in the ambient temperature being sufficient to change a safe bearing into a bearing approaching seizing point. The writer had an experience of this when rather sketchy railings round a large motor, were replaced by solid sheet metal guards. The driving end bearing ran hot, and caused a lot of trouble, until the guards were re-designed to allow a free flow of air, from an adjacent opening, around the offending bearing.

Nearly every maintenance man has his own special mixture as a remedy for hot bearings. Steam cylinder oil mixed with sulphur, or white lead, is an old and tested mixture. As the bearing is already hot, there is obviously no trouble with the lack of fluidity of this mixture when cold, but it should, of course, only be used to keep the motor running until it is possible to strip down, and make a full inspection. A more modern mixture for a bearing running hot, is to add automobile engine running-in compound containing colloidal graphite, to the ordinary grade motor oil. The addition of flake graphite to the motor oil is not recommended, as it tends to build-up, and clog the oil-ways.—*F. S.*

Earthing Through Conduit

A PECULIAR fault occurred in a small food factory. Men working near some small pump motors reported flashes on the wall. The wiring supplying these motors was in $\frac{3}{4}$ in. screwed conduit; and as regular preventive maintenance was carried out (motors and starters checked over, and insulation tested weekly, and tested for earth continuity annually) it was assumed that the men were mistaken, and had seen sunlight reflected on the white tiled walls.

Shortly afterwards, the engine-room attendant reported readings on the earth fault ammeter, which was connected to a c.t. on the strap between the alternator neutral bus-bar and earth. On inspection, this load was found to be fluctuating in the manner of a small motor stopping and starting.



Details of control gear fault

I had no indication whereabouts in the factory this fault lay; all the plant was running, and could not be stopped for wholesale testing. Eventually, by observation, the fluctuations were noticed to coincide with the stopping and starting of one of the motors mentioned earlier (3 h.p. 400 volts, 3 phase induction motor). As soon as possible the starter was opened for a quick inspection. It was a direct-on starter, and the insulation on the wire connecting the supply to one of the hold-on coils had chafed through. The wire had burned in two, the live side being clear of the framework, but the coil end of the wire had welded itself to the earthed metal "stop" button rod.

The circuit to the motor, which had continued to run without protest, was therefore completed via earth (giving the reading on the fault ammeter) with 230 volts on two phases and 400 volts on the third.

It was also discovered on a closer inspection, that the conduit to this starter had rusted

through in one of the threads where it was screwed into an angle box on the wall, giving intermittent earth continuity. As there was a current flowing through the conduit itself due to the fault in the starter, this intermittent contact, due to the vibration in the factory, had caused the flashing noticed earlier. The starter wiring was made good, and the conduit bonded across the break until it was convenient to renew it, and no more trouble was experienced.

Since the framework of the motor must have been intermittently alive due to the two faults occurring together, it could have caused shock, and the question is therefore raised as to whether screwed conduit alone is a sufficiently good earth, or whether some better form (e.g. an additional adequate copper conductor) should be used on the grounds of safety. The earth continuity test could quite easily fail to show up this break in the conduit, since there is an alternative (intermittent) path to earth via the liquid being pumped.—*F. S. Fawcett, G.I.Mech.E.*

Slip Ring Wear

WHEN a d.c. supply is taken via slip rings to provide the field excitation current required for an alternator or a synchronous motor, the negative ring may tend to wear away at a greater rate than the positive. On large machines, having steel rings and a large number of brushes per ring, a skin is formed on the rings so that usually the wear is very small. The wear is more noticeable on machines having brass or bronze rings. Even with well-bedded brushes actual contact may only be made at a few points at any particular instant, and the points of contact vary rapidly over the brush surfaces as the rings rotate and small arcs are formed (often invisible) across the small gaps between brush and ring. These arcs cause small particles of metal to melt and to be deposited on the brush, leading to scoring of the ring and additional local heating, which aggravates the trouble. This transfer of metal from ring to brush is electrolytic in nature, the negative ring being the anode and the brushes the cathode of an electrolytic cell, and the minute melted particles move from the anode to the cathode.

Wear caused by sparking due to such factors as incorrect brush pressure, brushes stuck in their holders or vibration on the brush-gear can, of course, take place on either positive or negative rings but excessive wear on one ring may be reduced by changing the polarity of the brushes as occasion demands.

In the case of a synchronous induction motor which has the rotor winding leads brought out to three slip rings it is possible for the rate of wear on one ring to be considerably greater than that on the other two. It will be clear that one of the rotor winding phases carries twice as much current as the other two, and the current passing through the slip ring to which this winding is connected is twice that which passes through the other rings. Care should be taken when installing such a machine to ensure that the two rings of similar polarity are negative so that the rate of wear on these rings, due to transfer of metal from ring to brush, will be much smaller than the wear would be on the other ring if it were negative.

The writer has seen several synchronous induction motors which have suffered considerable wear on one ring due to its being negative instead of positive.—*S. Woodhouse, A.M.I.E.E., Assoc. I. Mech.E.*

Emergency Rubber Bushes

A COMPLAINT was received that on starting an m.g. set, used for battery charging, a knocking sound was heard and that the sound stopped when the set was running. I inspected the set and found that the rubber coupling bushes had completely worn away allowing the coupling pins to come in contact with the driving half coupling. As usual no spare bushes being available the following temporary expedient was tried. A length of rubber tubing of approximately ½ in. internal diameter was obtained from the nearby railway hospital (an unforeseen advantage of being on good terms with the Medical Dept.). At first pieces were cut to correspond with the full length of the original bushes, but difficulty was experienced in getting these on the pins. Fortunately my wireman had a brain wave and suggested that maybe ¼ in. wide rings would go on easier. This was tried with success and on each coupling pin sufficient rings were sprung into position until a thickness equal to the original bushes was obtained. On completion, motor and generator were coupled up and put back into service. New bushes were ordered out and arrived some time afterwards. When the set was uncoupled it was found that the pieces of rubber tubing were still going strong—*W. H. Gatehouse.*

Contributions to this page dealing with specific items of interest to electrical engineers and maintenance men are welcome, and, if accepted, will be paid for at our standard rates. Contributions should be written on one side of the paper only and may be accompanied by sketches, which will be re-drawn for publication

ISOTOPES FOR INDUSTRY

F.B.I. One Day Conference Reveals Many Interesting Applications

THE application of radio-active isotopes—substances rendered temporarily radio-active without altering their normal physical and chemical properties—to act as "tracers" is by now well known to most engineers, and formed the subject of a recent article in these pages (*Electrical Times*, March 15, 1951, p. 431). The wide range of other uses which these products are finding in industry is not, however, so generally realised. Applications as diverse as the timing of long-delay relays, the measurement of linoleum thickness, or the elimination of static charges in nylon spinning were amongst the many described in a one-day conference, "The Use of Radio-Active Isotopes in Industry," held on Tuesday of last week. Convened by the Industrial Research Committee of the Federation of British Industries, in collaboration with the Harwell authorities, and held at the I.E.E., it provided a most valuable opportunity for industrialists to hear what was being done in this field, and to air their own problems.

The proceedings were divided into two parts. In the morning, short lectures were given by officials of the Atomic Energy Research Establishment including SIR JOHN COCKROFT, who gave a general introduction to the background of the subject, and an account of the products and services available at Harwell.

X Ray Substitutes

"Non-Destructive Testing" was the first technical paper, given by MR. W. S. EASTWOOD (Isotope Division, A.E.R.E.), who gave some interesting information on the use of γ rays from isotopes instead of X rays. The isotopes most frequently used in this connection are cobalt and iridium, having half-lives of 5·3 years and 70 days respectively. Iridium was of considerable assistance in examining steel from ½ in. to 1 in. in thickness, but from 1 in. to 4 in. cobalt or tantalum were to be preferred. From about 3 in. to 6 in., however, radon (an element in the form of a gas) was to be preferred to isotopes. The normal method of supplying isotopes for γ-ray photography was in the form of cylinders of 2, 4, or 6 mm. diameter. He showed a number of slides demonstrating the simplicity of the handling technique employed, including the examination of a weld in the Bailey Bridge erected for the Festival, and the photography of a peripheral weld in a steam pipe in a Spanish power station, where it would have been quite impossible to install X-ray equipment, quite apart from the difference in capital cost. Methods of "group" technique were also shown. Where exposures ran to the order of 2-3 hours, it considerably speeded up the processes if the items to be examined, each carrying its own film casette, were grouped in a circle around the source of rays.

Some remarkable photographs of faults discovered in steel were shown in the form of slides, including slag inclusion in a casting 2½ in. thick, porosity and shrinkage cavities in steel 6 in. thick and a hot tear in a casting 7½ in. thick.

Thickness Measurement

Passing from the more powerful y rays to the slower β rays which, being essentially fast electrons, are more easily stopped, Mr. Eastwood then described the working principles of thickness gauges which utilised an isotope source of β rays, detected by means of Geiger counters after either transmission through the material under test or, by the "back-scatter" technique in which the rays were reflected from the surface of the material on to the counter. The reflectivity of materials to β rays was proportional to their atomic number, and approximate curves of reflectivity plotted against atomic number were shown. Direct transmission methods were employed in measuring thickness of materials such as linoleum or plastic; back-scattering technique could be applied to the measurement of, say, the thickness of tin coatings on tinplate, with a very high degree of accuracy.

MR. J. L. PUTMAN (Isotope Division, A.E.R.E.) spoke on the subject of isotopes used as tracers, emphasising that since the change brought about by exposure to radiation was confined to the nucleus of an atom, the free electrons, and thus the extra-nuclear properties remained unchanged, so that chemical and physical constants, reactions to

temperature and pressure, etc., showed practically no difference. On the question of sensitivity of tracers he stated that quantities of, say, gold, could be measured down to 10^{-10} gm, while phosphorus in the form of P_{32} could be measured in quantities as small as 10^{-15} gm. Applications of tracers, in addition to the obvious ones of tracing buried pipes, etc., included liquid level determination outside sealed tanks, the measuring of metal in furnaces and the marking of the junction of different fluids travelling through pipe lines.

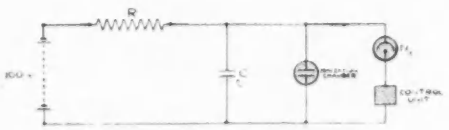
Other papers during the morning included "Some Applications of Labelled Organic Compounds" by Dr. W. P. GROVE (Radiochemical Centre, Amersham) and "Health Precautions" by MR. B. S. SMITH (Health Physics Division, A.E.R.E.).

Ionisation

Paper of greatest general interest to the electrical engineer was that given by MR. J. P. MORGAN (Enfield Cables, Ltd.) who dealt with the applications to research and manufacturing under the three main headings of ionising power, penetration and back-scattering properties, and detection, of the radiation from radio-active isotopes.

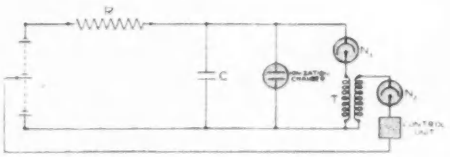
Since the initial discharge in a gas-filled tube depends on the presence of ions, the addition of an isotope will assist the formation of a discharge. This has already been applied in the case of tubes for radar equipment where response within a fraction of a microsecond is required and, in the absence of ions, the lag may be several thousands of times the required value. A source of radiation in the form of cobalt 60, introduced into the tube produced instant and reliable discharge characteristics. The same technique has been suggested to assist the starting of fluorescent lamps, while similar methods, using different isotopes have been used for stabilising the breakdown voltage of neon tubes by providing continuous irradiation.

Long-delay relays have also been designed using a combination of the ionising powers and decay characteristics of an isotope. In the simple circuit shown, the ionisation chamber



Simple circuit for long-delay relay

activated by an isotope, provides a leak across the capacitor C and prevents the neon lamp N1 from firing. Gradual decay of the isotope reduces the ionisation and the consequent leak, until the voltage rises sufficiently to strike the neon lamp, and energise the control unit or relay. Since the power available is very small, a "doubling up" arrangement is frequently used in which the discharge of N1 is used to provide a surge in a transformer primary which is utilised to fire a second neon tube. By this means, about 1 watt is available without amplification, and by suitable choice of circuit components and isotopes delays may be obtained varying from a few hours to several months.



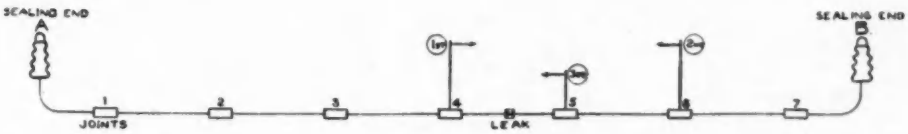
Improved circuit for long-delay relay

Under the second heading, Mr. Morgan pointed out that the applications of penetration and back-scattering to thickness measurement had already been dealt with in the morning session. A practical application in the electrical industry would appear to be the measurement of the thickness of semi-conducting glazes on h.v. insulators where accurate measurements were very necessary since minute variations in thickness of the glaze could lead to hot-spots.

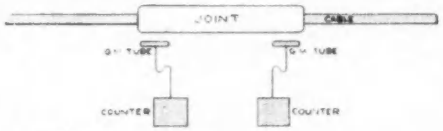
Tracer Applications

Uses of tracer technique dealt with in Mr. Morgan's paper included fundamental and applied research on such subjects as the actual electro-chemical action of lead storage batteries, the theory of copper-oxide rectifier action, and the study of acidity and sludging in insulating oils. Vulcanisation of rubber, corrosion of cable sheaths, wear of bearings, transfer of metal in switch contacts, and many problems in fundamental metallurgy were other problems in which valuable assistance could be given by isotopes.

The use of isotopes in locating leaks in gas pressure cables offered a less laborious method than that previously used, which depended upon the injection of oxygen into the line and analysing gas samples taken at various joints for their oxygen content. The new technique consisted



Diagrams show method of testing each joint (below) and order of making tests in locating leak (above)



in injecting a bubble of radio-active gas into a joint. Counter equipment of the Geiger-Mueller type is located at each end of the joint and the rates observed on both counters. That nearest to the leak will show an increase in counting rate, the other, a decrease. By successive "halving" of the cable run, the location of the leak will be approximately located between two joints, when other methods can be used to locate the exact spot. Experiments were proceeding on this portion of the problem. Previously published methods had required the drilling of holes to search for radio-active gas, and this, he considered, was impracticable where road surfaces were encountered. Gamma ray emitters were to be preferred, since these would penetrate road surfaces, and it should be possible to dispense with bôre holes. Experiments were being conducted with activated methyl bromide and, if successful, it was anticipated that a simple, speedy and sensitive method of leak location would be available.

Static Elimination

Another paper of general interest was given by DR. P. S. HENRY (British Cotton Industry Research Association), dealing with applications in the textile industry, where there seems to be a considerable future in the elimination of static charges. Apart from the mechanical troubles caused by mutual repulsion, the soiling of fabrics by electrostatic attraction of charged dust particles is an ever-present nuisance to the textile industry, when it is considered that two-thirds of fine airborne dust particles are so charged. The efficacy of discharge by β-rays was convincingly demonstrated on a suspended bunch of nylon filaments which, when lightly rubbed, assumed almost an umbrella-rib formation which remained unchanged until approached by a source of β-rays when they at once sank down into a solid cord once more. Static dischargers of this type use an isotope of thallium, in the form of a very thin foil backed with silver. They are enclosed in a protective trough and are removed from the machine when not required. The half-life of thallium is about 2.7 years.

Discussion on this paper included queries on the application to paper reeling machinery, where it seemed difficult to eliminate charges from the inside of the reel, and it was explained that providing the eliminators were placed close enough to the reel this trouble should not arise. Dr. Henry warned his audience, however, that in searching for static elimination, they should not overlook the simpler electric dischargers or even the ionised air over a flame, which was the simplest method of all but, of its very nature, impracticable for the textile industry.

Applications in metal fabrication were the subject of a paper by MR. C. B. FERGUSSON (G. A. Harvey and Co. (London), Ltd.), whose discourse dealt largely with γ-ray photography as against X-rays, but tackled the problem from the user's point of view. Radon, absorbed in carbon had shown many advantages over isotopes for examination of thick steel up to six inches or more. Its life was limited to a few days only, but this could be offset by the group technique, making multiple exposures simultaneously.

Future Developments

MR. K. FEARNSIDE (Isotope Developments, Ltd.) gave his views on the immediate future of the art. Transmission thickness gauges could already be built with an accuracy of 1%, and he visualised developments for accurate thickness measurement of hot steel sheets during rolling which would reduce the delay hitherto encountered with gauges suitable for slower moving materials, and which would shortly be installed in rolling mills. On the application of thickness gauges to control techniques, he pointed out that on a high grade paper mill it was possible to save the cost of the control gear in an afternoon's running. A number of individual problems were then discussed with members of the audience.

The Chairman, SIR WALLACE AKERS, C.B.E. (Chairman, F.B.I. Industrial Research Committee) wound up the meeting with a vote of thanks to the I.E.E. for facilities afforded in holding the Conference.

overseas news

Malaya Expansion

In the next few years $125 million will be needed for hydro-electric development in Malaya, and representatives of the Central Electricity Board have recently been negotiating for substantial loans from either the Federation Government or the British Government for the expansion programme. This scheme includes the completion of the second stage of the new Connaught Bridge steam station at Klan, and the provision of an all-Malayan grid system. In 1949, the Colonial Development Corporation agreed to provide a loan of $32 million for the first stage, but additional finance is now being sought, and Mr. F. P. Egerton, M.I.E.E., deputy chairman of the C.E.B., has had discussions with the Government Financial Secretary, Mr. W. D. Godsall. It is stated that there is also the possibility of buying equipment from America needed for the Connaught Bridge project because of delays in supplies from Britain. The first stage of this project is now expected to be complete about the end of 1952, although the original intention was to have it in commission this year. The power position in Malaya is rather delicate at the moment. Parts of one of the generating sets from the Bungsar power station in Kuala Lumpur are under repair in Britain at the present time. Meanwhile in Selangor and parts of Negri Sembilan about $1,000,000 worth of tin a month is not being mined because of lack of power, it is reported.

Zoning in Sydney

A new scheme of zoning of electricity supplies came into operation in Sydney, N.S.W., last week, in an effort to ease the burden of the ever-increasing black-outs. The area has been divided into five zones, or load groups, and a roster published showing the days of which use of electricity by industry and commerce is prohibited between 7 a.m. and 9 p.m. in each zone. Exemptions include banks, newspapers, doctors, dentists, foodstuff processing, dairy farming, etc. Mr. H. G. Conde has been nominated as Emergency Electricity Commissioner, with powers to issue certificates of exemption to important consumers, and to direct the supply authorities concerning load shedding. By these plans it is hoped to reduce the daily power load by about 20%. During the past few weeks black-outs in Sydney have been the worst in the history of the city, according to Mr. Conde. He recently reported that Bunnerong power station had again been affected by the poor quality coal, and both of the two new boilers had been out of action for a time. Additional generating plant for Bunnerong is expected in Sydney from Britain by the end of the year. In an effort to expedite delivery of other plant on order for New South Wales, Mr. Conde is shortly to leave by air for the U.S.A. and Britain. Eight 'packaged' units are on order from America—six from Westinghouse and two from General Electric.

Tariff Increase in Victoria

From July 1, the charges for electricity in Victoria will be increased by about 8 to 10%. The Chairman of the State Electricity Commission has said that the new tariff is necessary because of a general increase in wages and costs. The Commission's operational budget for the financial year 1951/52 disclosed an additional cost of approximately £2,000,000 for wages alone.

Progress in W.A.

Hard on the heels of the first report of the State Electricity Commission of Western Australia (E.T., April 19), comes the second report covering the 12 months to June 30 last. For this period, the loss on working of the Commission was reduced to £79,444—an improving sign. At East Perth power station, 3,000 kW of diesel units were installed, enabling the output to be increased to over 237 million units, and three 1,000 kW diesel units were installed during the year at Midland Junction workshops and at Welshpool, together with sets of smaller size in country districts. Good progress is reported on work on the South West Power Scheme but in view of the shortage of skilled labour, a linesman's school has been organised at Picton Junction. The frequency change-over work, too, is going well, and a census has been taken of about 50,000 consumers. But with power restrictions still applying, great store is set on getting the South Fremantle "A" power station into commission this winter.

T.V. Plan

The television station in Sydney, which is scheduled to start operating next year, will have a maximum potential market of almost 500,000 television sets, there being about 1,680,000 people within the range of the station, it is understood. At least ten local radio manufacturers are planning to enter the television field. Three manufacturers are stated to be considering production of cathode ray tubes, while others will import these and other components from overseas. Meanwhile, the Electrical, Radio and Telephone Manufacturers' Association has urged the Federal Government to erect T.V. stations in the capitals of all states.

Electrification in Nova Scotia

During discussion in the Province Legislature on an estimate of $335,000 as a subsidy to the Nova Scotia Power Commission under the Rural Electrification Act, some protests were made, and Premier Macdonald explained that the only immediate solution to the

problem would be to raise the minimum service charge from $3 per month to $5 or $6 per month or require that the costs of extending power lines to areas not qualified under the present act be borne by the home owners concerned. Under present legislation, three houses, with a fourth prospect, were required before the power lines would be extended under provisions of the Rural Electrification Act. One member urged that the Government take over private power companies which operated at good profits, thereby making it possible to distribute electrical service to the more isolated parts of the province on an economical basis. Premier Macdonald replied that the Province last year received $210,000 as its share of taxes paid by such concerns to the federal Government, so it was not a dead loss to have private companies in business.

Calgary Expansion

Generating capacity of Calgary Power, Ltd., will be increased to 132,000 h.p. with completion of the 12,000 h.p. addition to the Kananaskis plant next month. On the Spray Lakes project a 12 by 12 ft tunnel will be drilled for a distance of 1,250 ft through the rock on the south side of Whiteman's Pass to replace the canal destroyed by a landslide last December just when the 62,000 h.p. Spray plant was being made ready for operation.

Centralisation

Under a new centralisation scheme the head office of the British Columbia Power Commission in Victoria will soon take over most of the administration for the province. Temporary regional offices in Nanaimo and Vernon will be relieved of billing, engineering, accounting and payroll work which will be handled directly from Victoria. Chairman of the Commission, Mr. S. R. Weston, has explained that those regional offices had never been intended as permanent control centres. The Vernon and Nanaimo offices were not to be closed, but more local managers would remain with greater control at distant offices which would be maintained where the commission has plants.

New Winnipeg Organisation?

The latest development in the Manitoba power reorganisation scheme is the formulation of a draft Bill providing for the establishment of a Greater Winnipeg Public Utility Board to purchase the City Hydro and the Winnipeg Electric Co's gas, transportation, steam heating and electricity distribution systems and retail appliance business. Thus, under this Bill, the Board would purchase those assets of the Winnipeg Electric Co. not acquired by the Manitoba Hydro-Electric Board, and, apparently, would take a bulk supply from the latter Board. The Manitoba Hydro-Electric Board would take over the operation of the City Hydro's two power plants at Slave Falls and Pointe du Bois. Another aspect is that the City would no longer be able to utilise profits for alleviation of the rates.

Grants in Norway

The Norwegian Government has approved a grant amounting to kr. 42,945,000 for the extension of electricity supplies to districts which are still without it or are only poorly provided for. Of this sum, kr. 34,756,000 is to be spent over a period of five to six years. Eventually, about 125,000 people will be provided with electricity in these districts. The Government has also approved an additional grant of 15 m. kr. towards the cost of constructing the Aura electric power station. In addition the Government propose to permit the Bardufoss power station to obtain an extra flow of water by lowering the level of the Altenvatn outflow to the extent of three metres. This will allow the generation of additional power for Troms and Tromso city, and bring electricity for the first time to about 15,000 people.

Progress with Geothermic Tests

New Zealand's hopes for utilising geothermic steam for electricity generation are increasing. Our latest report, from authorities in Wellington, suggests that thermal steam in the Rotorua district is expected to be producing electricity within the next five years. Although they are guarded in their comments, the authorities seem satisfied that there is sufficient steam available and at a fairly static pressure. No great difficulty is anticipated in obtaining low pressure turbines for the thermal steam project, but no orders will be placed by the Government until the State Hydro-Electric Department is positive that the Wairakei tests are completely satisfactory. A new 8 in. bore at Wairakei is spouting steam at least 100 ft in the air and has been doing so for some time. The general opinion is that practically all the bores which have been sunk have proved satisfactory, Mr. J. B. Brooke, director of the Auckland Industrial Development Laboratories, has stated that there are now about 20 man-made bores in an area of 10 sq miles near Wairakei. Temperatures at the bottom of the bores, about 1,000 ft down, were approximately 450° F., the steam pressures being some 500 lb/sq in.

Electrification Delayed

Because of a shortage of staff, progress on the £6,000,000 electrification of the Hutt Valley railway line, North Island, N.Z., has not been maintained at a rate that will enable the change-over to take place in 1952, the Railways Department has announced. The engineering work between Wellington and Taita is to be pushed forward, but a power supply is the main concern as a full service cannot run until Maraetai generating station is commissioned in 1952. Distribution of power to appropriate points on the Taita section of the line is dependent upon the completion of the State Hydro-Electric Department's Hayward's sub-station. This work may not be completed until the beginning of 1953.

PERSONALITIES

IN THE INDUSTRY

The Exeter Electric Club, whose formation we referred to on February 22, is now in being, we learn, and the programme for the coming winter has been drawn up. At the first Council meeting held recently, **Mr. H. Peters** was elected President, and **Mr. L. W. Cornish** vice-president, **Mr. G. S. Mogridge** is hon. secretary, and **Mr. H. Bicker** was elected hon. treasurer.

The General Electric Co. has appointed **Mr. D. L. Tabraham,** F.I.E.S., as manager of the Lighting Fittings and Illuminating Engineering Departments, in succession to Mr. A. J. Burbidge, whose retirement we noted last week. **Mr. D. W. Durrant** is the new deputy manager of those departments. Mr. Tabraham joined the G.E.C. in 1937 and worked in the illumination section of the company's research laboratories for eighteen months, subsequently transferring to the Illuminating Engineering Department at head office. After the war he became manager of the Lighting Fittings, Illuminating Engineering and Exterior Lighting Departments of the North Eastern area of the G.E.C., and in June, 1949, became assistant to Mr. Burbidge at head office. Mr. Durrant has had considerable experience in the firm's lighting fittings design office. In 1943 he was appointed assistant to Mr. Burbidge, and since the end of the war he has concentrated on the development and production of lighting fittings. He is at present chairman of the Fluorescent Fittings Committee of E.L.F.A.

Mr. D. L. Tabraham

Mr. A. R. Northover, director and works manager of Hoover (Washing Machines) Ltd., Merthyr Tydfil, has been re-elected president of the South Wales and Monmouthshire Section of the Institution of Production Engineers.

Dr. C. F. Bareford, head of the Mullard electronic research laboratory, has been made a director of Mullard Equipment Ltd.

Superintendent at Exeter generating station since 1921, **Mr. A. G. Buchanan** retired from that position a few days ago after 45 years' service. To mark the occasion, Mr. G. W. Clarkson, chief generation engineer, operation, presented him with a portable radio set subscribed for by his many colleagues and friends.

Formerly chief civil engineer to the Hydro-Electric Commission of Tasmania, **Mr. A. R. Shepley** has accepted an appointment with the State Electricity Commission of Victoria. Mr. Shepley has played a large part in planning the development works now being undertaken in connection with new power schemes in Tasmania. He is well known in Britain, for he visited this country last year, inspecting various power projects, and visits the works of manufacturers of plant on order for the Commission.

Mr. A. L. G. Lindley, M.I.Mech.E., has succeeded **Mr. F. Lonsdale** as general manager of Fraser and Chalmers Engineering Works of the General Electric Co. Ltd., Erith. Mr. Lindley joined Fraser and Chalmers in 1918 as an apprentice and after spending some years as an assistant engineer in the mining department was appointed in 1933 chief engineer for the British General Electric Co. Ltd. in South Africa.

Mr. A. L. G. Lindley

He was later appointed assistant general manager and a director of that company.

The British Electricity Authority has announced the appointment of three new divisional Controllers. **Mr. H. V. Pugh,** M.I.E.E., M.I.Mech.E., at present divisional controller, South Wales, is to be controller of the London Division on the retirement of **Mr. J. N. Waite. Mr. L. F. Jeffrey,** B.Sc., M.I.E.E., M.Inst.C.E., M.I.Mech.E., at present chief generation engineer (construction), Midlands Division, is to be controller of the East Midlands Division on the retirement of **Mr. W. S. Burge.** The third appointment is that of **Mr. H. J. Bennett,** A.M.I.E.E., now chief generation engineer (operation), London Division, who willsucceed **Mr. H. V. Pugh** as controller of the South Wales Division.

Newly elected chairman of B.E.A.M.A. for the 1951-52 session is **Mr. T. F. Lister,** chairman and managing director of the Hackbridge and Hewittic Electric Co. Ltd. **Mr. I. R. Cox,** D.S.O., B.Sc., M.I.Mech.E., A.M.Inst.C.E., managing director of Metropolitan-Vickers Electrical Co. Ltd., was re-elected vice-chairman for the same period. A Yorkshireman, Mr. Lister served with Ferranti, Ltd., and the General Electric Co., Ltd., before going in 1905 to Metropolitan-Vickers Electrical Co. Ltd. (then British Westinghouse), where he remained for twenty years. During this time he gained valuable experience in the Large Machine Division, Switchgear, Transformer, and Meter Departments. After the 1914-18 war Sir Holberry Mensforth started a main production department covering the whole of the Trafford

Park works and Mr. Lister was appointed first superintendent, a position he occupied until 1925, when he left Trafford Park to take up the position of manager of the Hackbridge Electric Co. In 1926 he became manager also to the Hewittic Electric Co. Ltd., which had been acquired by the Hackbridge Co., becoming director of both companies in 1931, managing director of these companies and also the New Switchgear Construction Co. Ltd. in 1944. He was appointed chairman and managing director in 1946 and the following year became chairman and managing director of the newly amalgamated group, the Hackbridge and Hewittic Electric Co. Ltd.

Mr. Cox joined Metropolitan-Vickers Electrical Co. Ltd. (then British Westinghouse) as a college apprentice, and in 1913 became assistant turbine engineer. On returning to the Trafford Park

Mr. T. F. Lister

Mr. I. R. Cox

works in 1919 following war service, he worked as turbine engineer until 1927, when he went to Russia as chief mechanical engineer for the company in charge of turbine work in that territory. He afterwards visited Australia, the U.S.A. and Turkey on the company's business. In 1941 he was appointed joint managing director of Metropolitan-Vickers Electrical Export Co. Ltd., becoming managing director in 1944. In the same year he was elected to the board of Metropolitan-Vickers Electrical Co. Ltd. as a director, appointed general sales manager in 1946 and shortly afterwards managing director of the company. He is also deputy chairman of the M.V. Electrical Export Co. Ltd., chairman of both the Edison Swan Electric Co. Ltd. and Metro-Cutanit Ltd.

Mr. C. Buckle, A.M.I.E.E., has been appointed engineer-in-charge of the television transmitting station which is now being built at Holme Moss, near Huddersfield. Mr. Buckle's assistant at Holme Moss will be **Mr. J. P. Broadbent**, who is at present one of the senior engineers at the Droitwich transmitting station.

Sir Charles Colston, C.B.E., M.C., D.C.M., chairman and managing director of Hoover, Ltd., has accepted an invitation to join the Board of the American organisation, the Hoover Co., of North Canton, Ohio—a tribute to the success of the British organisation and Sir Charles, who directs it.

The end of the month brings the retirement of **Mr. A. E. Jones,** district executive officer at Lymington, to the Southern Electricity Board, who has served for over 50 years in the Supply Industry. He started with head office staff of Edmundsons Electricity Corporation in 1900, transferring in 1906 to an associated company, the Lymington Electric Light and Power Co., with which he became assistant manager and secretary in 1910. Returning from war service in 1918, Mr. Jones was appointed engineer and manager, holding that position till 1937 when he was nominated district manager on the purchase of the undertaking by the Wessex Electricity Co. On nationalisation of the industry, he became district executive officer. Under Mr. Jones's 30 years of management the Lymington undertaking has expanded considerably—output has increased from 140,000 units to 12 millions, and consumers have risen from 400 to 3,400, the annual income having jumped from £3,000 to about £73,000.

About the end of this month **Mr. J. G. G. Noble** is joining Argosy Radiovision Ltd. as sales director. He thus joins an old friend, **Mr. E. St. P. Iddon,** managing director of the firm, whose son **Mr. Peter Iddon** will be Mr. Noble's assistant. Also with this company are **Mr. D. H. Overton,** a director, who is taking charge of finance and internal economy with **Mr. F. J. Messum** as general manager.

Newly appointed deputy manager of the Northmet sub-area of the Eastern Electricity Board is **Mr. W. M. Maynard,** M.I.E.E., who, since vesting day, has been southern area superintendent in that sub-area. He succeeds **Mr. A. H. Watson,** M.I.E.E., who retired last month. Mr. Maynard was educated at King Edward VI School at Southampton, and received technical training at Faraday House and with the Brush Electrical Engineering Co. Following war service, he joined the Northmet Power Co. in 1920 as assistant engineer at the Enfield district and subsequently became district superintendent.

OBITUARY

The death occurred on May 3 of **Mr. G. N. Robbins,** aged 61, who was with the International Refrigerator Co. Ltd., from 1931 to 1941, latterly as general sales manager, before joining the London lamp sales division of Edison Swan Electric Co. Ltd. as senior London representative, from which position he retired last year.

Mr. J. D. Findlay, M.I.E.E., M.INST.F., system operation engineer to the Midlands Division of the B.E.A., died on April 25. Prior to nationalisation he was with the Central Electricity Board as control engineer and chief assistant operation engineer, Central England District. Earlier experience he had gained with the South Wales Power Co., and at Plymouth, Fulham and Newcastle, after spending some time with the B.T.H. Co., and Johnson and Phillips.

Mr. R. J. Morgan, managing director of Tyne and Wear Electrical Co. Ltd. has died, aged 74.

NEW LITERATURE

Lexique-Technique Anglais-Français

by G. Malgorn

ENGINEERS faced with translation into French will find considerable help in this technical dictionary, which covers a wide range of terms used in mechanical, electrical and civil engineering, and in metallurgy. Direct equivalents are given, with no attempt at definition. Published by Librairie-Imp. Gauthier-Villars, 55 Quai des Grands-Augustins, Paris 6, 322 pages, 8½ in. by 5½ in. Third edition. Price 1,300 francs.

How to Write Technical Books

by John Gloag

BOOKS on writing technical books are only too often comparable with suet pudding—nourishing and very good for one, but dull and uninspiring. In this, Mr. Gloag serves us a dish which contains all the excellent qualities of the suet pudding, with the attraction and digestibility of a well-cooked omelette. The title of the first chapter, "They don't want to read it," gives a fair clue to the general approach, as does the third chapter heading "Say What You Mean." The actual mechanics of the job, manuscript preparation and illustrations, are very thoroughly dealt with, and the author devotes considerable space to a subject which is often summarily dismissed, that of relations between author and publisher, with some amusing pictures illustrating their ideas of each other. There are additional chapters on the production of technical documents, reports and memoranda, and on the reform of forms, which contains some really excellent suggestions. The purpose of the book might really be summed up as "Authorship Without Tears," and it is not only the lachrymatory glands of the would-be author which are to be kept in a state of quiescence but those of the publisher and printer as well, *How To Write Technical Books* is published by George Allen and Unwin Ltd., at Ruskin House. Museum Street, W.C.2, price 12s. 6d. net.

Semi-Conductors

by D. A. Wright, M.Sc., F.R.A.S., F.Inst.P.

AN increasing range of applications is being found for the class of materials known as semi-conductors, and the addition of this volume to Methuen's "Monographs on Physical Subjects" is timely. It deals especially with electron flow in semi-conductors and across the boundary between such substances and either a metal or a vacuum. The object is essentially to present the basic theory, and there is only brief reference to practical applications and experimental results. Introduction is by way of considering electrons in metals and in crystals. The various factors bearing on electron emission from semi-conductors are next considered, and methods of determining the electron density are discussed. A long chapter is devoted to secondary emission, and the book then closes with shorter notes on metal/semi-conductor contacts, thermionic cathodes, and photo-electric cathodes. Published by Methuen and Co., Ltd., 130 pages, 6½ in. by 4 in. Price 7s. 6d.

NEW BOOKS

Capacitors for Industry, edited by W. C. Bloomquist. American text book on power factor correction. Published by Chapman and Hall, 246 pages, 9 in. by 5¾ in. Price 36s.

Gas Discharge Lamps by F. Furke and P. J. Oranje. Philips Technical Library volume on characteristics and application of the various types. Published by the Cleaver Hume Press Ltd., 42a South Audley Street, 288 pages, 9½ in. by 6 in. Price 30s.

Practical Wireless Service Manual by F. J. Camm. Published by Newnes, 288 pages, 7¾ in. by 4¾ in. Price 8s. 6d.

Circuit Analysis of A.C. Power Systems by Edith Clarke. Discusses circuit components other than o.h. transmission lines. Published by Chapman and Hall, 396 pages, 9 in. by 6 in. Price 68s.

Design of Electrical Apparatus by J. Kuhlmann and N. F. Tsang. Machine design text book for graduate classes. Published by Chapman and Hall, 512 pages, 9 in. by 6 in. Third edition. Price 52s.

Electric Power Stations, Vol 2, by T. H. Carr. Revised and expanded edition of standard work. Published by Chapman and Hall, 814 pages, 8½ in. by 5½ in. Price 75s.

Mind, Life and Body by R. O. Kapp. Philosophical discussion of causation Published by Constable and Co. Ltd., 196 pages, 7¾ in. by 5 in. Price 12s. 6d.

Radio Technology by B. F. Weller. Text book for City and Guilds examinations. Published by Chapman & Hall, 480 pages, 8½ in. by 5½ in. Third edition, Price 30s.

Converting a Business into a Private Company, by S. Borrie. Simple description of procedure and advantages. Published by Jordan and Sons, Ltd., 54 pages, 7½ in. by 5 in., 14th edition. Price 3s. 6d.

Bearing Lubrication. Practical information on design of bearings from lubrication angle. Published by C. C. Wakefield and Co., Ltd., Grosvenor Street, W.1, 134 pages, 10¾ in. by 8½ in. Price 21s.

Radio Circuits, by W. E. Miller. Step by step survey of superhet receivers. Published by Trader Publishing Co., Ltd., 120 pages, 8½ in. by 5½ in. Third edition. Price 5s.

Wiring Circuits, by E. Molloy. Wiring and connection of many kinds of power and lighting circuits and machines. Published by George Newnes, 216 pages, 8½ in. by 5½ in. Price 10s. 6d.

Proceedings of the Second British Electrical Power Convention—1950. Published by B.E.P.C., 16 Stratford Place, London, W.1. 351 pages, 8½ in by 5½ in.

FASTER FLASHES

Development of a High-Speed Power Stroboscope

FOUR authors combined to write the paper, "A New Power Stroboscope for High-Speed Flash Photography," which provided the main business of the I.E.E. Utilisation Section at its meeting last Thursday. Those concerned were Messrs. W. D. Chesterman, B.Sc., F.Inst.P., and D. R. Glegg (R.N.S.S.), G. T. Peck (Ernest Turner Electrical Instruments, Ltd.), and A. J. Meadowcroft (Siemens Electric Lamps and Supplies Ltd.)

The paper commenced with a description of the photographic problems of high-speed moving-film photography, which is a most useful tool in many research investigations. Translated into electrical terms, the solution required was an electrical control circuit to deliver high-repetition-rate pulses to a light source, and the production of a lamp of reasonable life which would withstand the very high power-dissipation involved, and yet have a very short flash duration.

In the early stages of the investigation a low-pressure xenon-filled tube was used, with a conventional type of external trigger electrode. This was later modified to a heavy-current hydrogen-filled thyratron (short deionisation time) controlling the electrical pulse, and high pressure smaller bore xenon-filled tube to keep down the duration of the light flash, which is considerably greater than that of the electrical pulse.

Hydrogen Thyratron

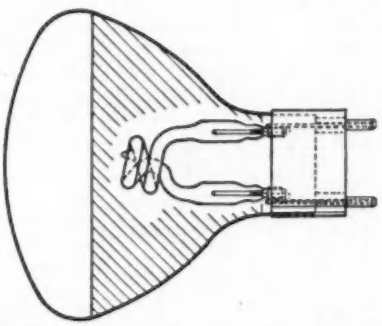
Advantages of the hydrogen thyratron used in the stroboscope (B.T.83) lie in the high fall of cathode potential which can occur without injury to the oxide coated cathode, thus allowing the use of high voltage operation and heavy pulse currents. The short deionisation time, already mentioned, made a high repetition rate possible. The ionisation time and the shape of the voltage-time curve during ionisation are relatively independent of the external circuit, so that they were almost entirely a function of the physical characteristics of the valve.

For control purposes, since the thyratron is designed for positive grid control, it was necessary to establish a current between grid and cathode. The pulse generated in a multivibrator was amplified and passed through a cathode-follower stage to the grid of the hydrogen thyratron. At this point it had an amplitude of approximately 350 volts, with a rise time of less than one microsecond and an overall duration of two microseconds.

Since recombination of ions takes place largely at the grid surfaces, it can be encouraged by the application of negative bias to the thyratron, a feature that was of particular advantage at the higher repetition frequencies.

Light Source Design

In its final form, the control circuit delivered a 13·1 kV positive peak pulse to the lamp, producing a current of 583 amp lasting 1·8 microseconds. Instantaneous peak power



General construction of the flash tube, showing the spiralled xenon tube and the silvering of the containing bulb

was 2·74 MW, and total energy dissipated in the lamp per flash was 1·9 joules. After much experiment, it was found that with a gas pressure of 100 mm. mercury and a quartz tube of 3 mm. dia. bore, it was possible to reduce the flash duration to 4·8 microseconds with 12 kV nominal voltage and 0·125 μF storage capacitance. Flash duration was measured from initiation to the instant when light output had fallen to one-tenth of its peak value.

In the concluding sections of the paper, a description was given of some applications of the stroboscope to research problems. The lamp in its final form had a repetition rate of flashing controllable over the range 100 to 4,000 flashes/second. Lamp life was estimated at 250,000 flashes. Control of repetition rate was accomplished by an oscillator circuit of the type described above.

One of the phenomena examined during the investigation, and which proved of considerable general interest, was that of light output from the tube after the current pulse had ceased. In one example, the light output from a low pressure xenon tube measured photographically, continued for about 30 microseconds although the electric pulse ceased after 2 microseconds. With a high pressure tube (100 mm mercury pressure) the light output dies away much more rapidly. A probable explanation is that there are metastable levels in the excited xenon atom, and it is these delayed returns to the zero-potential state which account for the continuing light output.

Delayed recombination has been observed in the hydrogen spark discharge by other investigators and it has been shown that deionisation times increase as the atomic number increases in the inert gas series: though this is not quite the same process as the after-emission of light.

It was not possible, in the investigation described in the paper, to pursue the xenon research very far, although the subject is one of great practical and theoretical interest. It was felt by the investigators that the interrelation between the electrical characteristics of the discharge and the light output were not fully understood.

DISCUSSION

Professor J. M. Meek (Liverpool University) pointed out that use was being made of the stroboscope in Liverpool for zoological studies. While he found little in the paper to criticise, he thought it unfortunate that half the energy in the thyratron was dissipated. He wondered whether attempts had been made to improve the tubes by still further increasing the gas pressure or decreasing the diameter of the tube, making it smaller and flatter. Use had been made in Liverpool also of high-speed electronic shutter mechanisms. He said that the investigation of afterglow phenomenon was a major part of the research work.

Dr. J. B. Aldington (Siemens) recommended further investigation into the problem of afterglow. The position had been reached when the research worker in the applied field had enough information for his particular purpose, but the shape of the afterglow time-characteristic for xenon, for instance, offered points of considerable theoretical interest and was a matter for pure research.

Mr. H. de B. Knight (B.T.H.) said it was of particular interest that the authors had brought together the lamp and the valve about which there was so often a conflict of interest. This subject was of equal interest to those working in both lamps and valves. The currents used by the authors seemed very high, for the particular valves adopted. One advantage of the hydrogen thyratron was that it had two discharge paths in series which both had to be deionised. It was possible to deionise with two more rapidly than with one. He was of the opinion that the hydrogen thyratron as such could be made to operate to higher frequencies, provided one accepted shorter life in the interests of the job. Afterglow was also of interest to the development of both lamps and valves. He thought a distinction had to be drawn between two processes—deionisation and de-excitation, and suggested that information was required as to what processes caused rapid de-excitation. Very little seemed to be known about how a neutral atom in a metastable condition could be forced to de-excite quickly.

Mr. N. W. Robinson (Mullards) drew attention to the fact that in one table the figures of xenon-filled tubes showed a shorter flash time for the longer as compared with the shorter tubes. He asked whether there was any peculiarity about their respective shapes.

Mr. E. J. G. Beeson (B.T.H.) pointed out that with shorter flashes there was considerable loss of light intensity. He also drew attention—in connection with the measurement of high peak currents—to the difficulty of obtaining a suitable non-inductive resistor.

Mr. G. A. Gilbert (Mullards) observed that the electronic light shutter or convertor tube had provided some solution to the problems of high-speed photography.

The authors briefly replied.

Code of Practice

Ducts for Services. Latest Code of Practice to make its appearance in final form is Code 413, "Design and Construction of Ducts for Services." It deals with the design and construction of all forms of ducts for the accommodation of pipes, cables, etc., within and adjacent to buildings. With regard to preliminary exchange of information, the importance of early and thorough co-operation between the various parties concerned is stressed—especially with a view to the possible future extension or alteration of the services required. Notes are included on the preparation of a time schedule.

Types and arrangement of ducts, chases, trenches and subways to suit the various requirements of the services they carry are described in considerable detail. Guidance is given on the methods of, and materials for, construction; and details are set out regarding the access arrangements, suppression of noise, avoidance of transmission of heat, and, in particular, the precautions necessary to ensure that the system of ducts does not increase the fire risk in a building. The Code concludes with recommendations on inspection and general maintenance of the completed ducts.

Copies of the Code may be obtained from the British Standards Institution, 24/28 Victoria Street, London, S.W.1, price 3s., post free.

Workers in Nationalised Industry

Their Needs outlined by E.T.U. President

KEEN disappointment at the progress made in the nationalised Electricity Supply Industry, particularly in regard to the relationship between workers and management, was expressed by Mr. Frank Foulkes, general president of the Electrical Trades Union, at the Union's policy conference which opened at Hastings on Monday. From the 1947 Act they had looked for a new outlook from the Authority and the Area Boards, but the attitude of management to workers had not changed, managerial functions were still used as an excuse for imposition, he argued. The basis of wage adjustment had not changed, for they now argued with the Authority and the Boards on the same basis as they argued with private employers prior to nationalisation, and whilst the method of presenting accounts had changed, the fundamental principle of capitalism remained.

A Demand

Interest on loans, compensation payments and surplus were still the first charge on the industry, and those charges, therefore, determined the wages of the manual workers.

Artificial barriers still existed between black-coated, technical and manual workers. An adequate sick pay scheme and a superannuation fund were not considered necessary for the manual workers, yet the technical and administrative and clerical staffs were in receipt of such benefits.

He urged that they demand:

(*a*) direct participation by the workers in management;

(*b*) complete liquidation of compensation stock;

(*c*) a new method of approach to wage claims, based on the individual's value to the industry;

(*d*) wages and salaries adjustments to be the subject of precise pre-budgeting in the same way as capital charges and revenues.

Bethnal Green Dispute

Turning to the electricians' dispute which started at Bethnal Green recently, he asserted that the dispute was designed to challenge the E.T.U.'s role of sole negotiators within the electrical contracting industry, although others had said it was an inter-union dispute—which he denied.

He found it difficult to understand the attitude of those who were earlier associated with the Union taking up a stand which was diametrically opposed to the principles they enumerated when they were in office in the Union. The rights of the E.T.U. within the contracting industry were never challenged by electricity supply employers, but advantage was taken of the nationalisation of the supply industry to initiate a campaign against the Union in order to undermine its strength. The dispute at Bethnal Green was only an incident in the general campaign to prevent the Union asserting itself, and could easily have been settled had not the significance of the move been so apparent.

Mr. Foulkes also argued that the action of the B.E.A. in reporting to Parliament that all but 150 employees (which included employees with no unions) would be covered by negotiating machinery meant that they had pre-judged the Inquiry Committee's findings and anticipated that the 10,000 members in contracting departments would conform to the desires of the B.E.A. and relinquish their unilateral rights to negotiate. But whatever the result of the Inquiry, he warned the B.E.A. and the Boards that the struggle would continue; the principles involved were so tremendous that where and when the Union was able to do so, it would again raise the position, for, if they were forced to share the negotiations for these employees, the desires of the members and the decisions of the Executive Council would be subject to ratification by other organisations not so progressive as their own.

Holidays with Pay Claim

During Monday's session, a resolution from Birmingham urged that any advance gained nationally in negotiated agreements should not be detrimental to local agreements. It was pointed out that as a result of a recent agreement, electricians in the gas industry in Birmingham had received an increase of as little as 85% of ¾d. Resolutions urging sick pay and a five-day week for members employed in the electrical contracting industry were carried. The executive was recommended to consider negotiations with the N.F.E.A. for a five-day week, and another motion asked for a sick pay scheme on the lines of that operating in the nationalised industries. Mr. R. G. McLellan, for the executive, emphasised that there would have to be much activity by the members as well as the executive if such concessions were to be obtained, as a spokesman for the employers had been talking recently in terms of a 47-hour week. This appeal was underlined shortly afterwards when a resolution calling upon the executive to negotiate for two weeks holiday with pay plus statutory holidays for all workers in the electrical contracting industry was discussed. Mr. McLellan said he had just been informed that the National Arbitration Tribunal, which met last week, had found that the Union's claim for two weeks holiday with pay had not been established.

The conference carried a composite resolution which asked the executive to do all in its power to

obtain for manual workers employed by the B.E.A. hours of work, pay and conditions comparable with those of the clerical and administrative workers. One member complained that many employees were leaving the service of the B.E.A. to earn more money in industry. The resolution also expressed the opinion that unless the B.E.A. faced the fact that the rates of pay for their manual workers were low in comparison with those of private enterprise, it would be impossible for the Authority either to retain or recruit the best type of worker. On behalf of the executive, Mr. J. Humphrey said that they were working on the lines indicated by the resolution. They were hopeful of getting a contributory pensions scheme introduced for manual workers employed by B.E.A. not less favourable from that which applied to the clerical workers. The Authority's difficulty in getting labour was due to the policy that no worker should get more than the scheduled N.J.I.C. rate when coming into the industry. The man power shortage would exist until the Authority were prepared to revise that attitude.

Annual Report

Membership of the Union continues to grow—at December last it was 192,339, an increase of 4,819 over the previous year—the annual report of the Executive Council, which was presented at the Conference, records. Little progress has been made in the establishment of a college, the latest property in mind being at Kingston, but many difficulties have yet to be overcome. Reference is made to the survey of canteens in the supply industry, undertaken by the Welfare Committee, as the result of which recommendations were sent to the various Boards concerning the provision of meals at a reasonable price. An extension of the meals service is also suggested.

The result of the researches of the general secretary into the proposal to set up a superannuation scheme makes interesting reading, for the majority of the Unions approached on the matter have indicated that difficulties were met in operating the schemes. In some cases the amount of superannuation payment has been cut, or suspended temporarily, while in many cases such payments are restricted to a certain section of the membership.

Pointing that if the Union adopted such a scheme it would have to apply to all members, Mr. W. C. Stevens, general secretary, considers that it would involve an annual payment of approximately £200,000. The Union's total contributions last year, excluding the political fund, was £366,506.

HAVE POLITICIANS CAUSED THE SHORTAGE?

Outspoken Comment on Auckland's (N.Z.) Power Position

THE serious impact on the finances of the Auckland Electric Power Board, New Zealand, caused by electricity rationing, is clearly shown in the annual report of the Board for the year ended March 31, 1950. That year's operations resulted in a loss amounting to £18,300 compared with a profit of £65,700 for the previous year. Revenue from all sources for the year was £19,880 down in 1948-49, the result mainly of the saving of over 13 million units by domestic consumers because of rationing. Also to be taken into account is an increase of £49,163 in operating expenses and a rise of £14,977 in capital charges. In fact, the over-all deterioration during the year amounted to £84,020, for the cost of power purchased from the State Hydro Electric Department under the bulk supply agreement also jumped by £20,689.

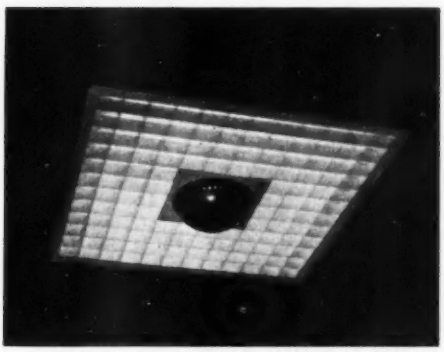
The total number of units sold during the year amounted to over 385 millions, a reduction of about 5 millions over the previous year, yet consumption by commercial power increased by over 9 million units. Actually, there was some 9,000 kW of new commercial load connected, but much of this was regarded as essential industry. Despite the effects of rationing, the Board continues to expand in the domestic electrification sphere, for a further 2,864 electric cookers and 2,850 water heaters were connected to the system, and the Board now services all cookers, whether owned or rented. Expenditure on maintenance of the distribution system, was reduced during the year. Mr. C. J. Lovegrove, chairman of the Board, feels that it would be unwise to allow a further deterioration, and suggests that the staff might be augmented by immigration, with Government assistance. Mr. R. H. Bartley, M.I.E.E., M.I.Mech.E., general manager, who retired last November (his successor is Mr. N. M. Speer), also considers it advisable to provide for new substations, and their associated switchgear and buildings, e.h.t. cable links and feeders etc., to cater for the stored up demand which will obviously come as the new power plants start operating. The major part of this work is already planned.

But it is concerning the future power outlook that Mr. Lovegrove is forthright, for although he had earlier ventured the opinion that power generation by the State and its distribution by elected representatives of consumers, was a sound policy, he now feels that the generation of power should be taken beyond the orbit of political control. In fact, he believes that the control of power-generation in the Dominion at the whim of politicians, has been responsible in a large measure for the present shortages. The suggestion is made that there might be a Commission acting under statutory authority beyond political control, but responsible to Parliament.

The BUYER'S *Column*

The Amhurst '51 Series

DEVELOPED recently by COURTNEY POPE ELECTRICAL), LTD., Amhurst Park Works, Tottenham, London N.15, a new fitting has recently been installed in the "White Bear Inn" at Piccadilly, London. First of the Amhurst '51 series, the fitting utilises a 150 W tungsten lamp in conjunction with a pierced anodised aluminium reflector bowl which directs the light from the 150 W lamp to the main reflector and down the diffusing panel. This diffusing panel may be either in "Contralux" or in the form of a metal-louvred screen.



In this picture the new fitting uses a metal louvre diffuser

One of the main attractions of this fitting is that the colour of the spun glass medium in the Contralux diffuser may be varied to give colour correction for any particular purpose. The piercings in the anodised aluminium reflector bowl may be altered to suit individual tastes. Should cold cathode tubes be added they may be fitted above or below the reflector according to choice.

X-Rays For Industry

NOW that the use of X-rays has been accepted in industry as a means of achieving an efficient method of non-destructive testing it is natural that the accent is on development of equipment to keep abreast of current industrial problems.

PHILIPS ELECTRICAL CO., Century House, Shaftesbury Avenue, London W.C.2 have, therefore, devoted a great deal of attention to the production of the new "Compactix" unit, new in conception, which leads to simplified procedure and a speedier rate of inspection.

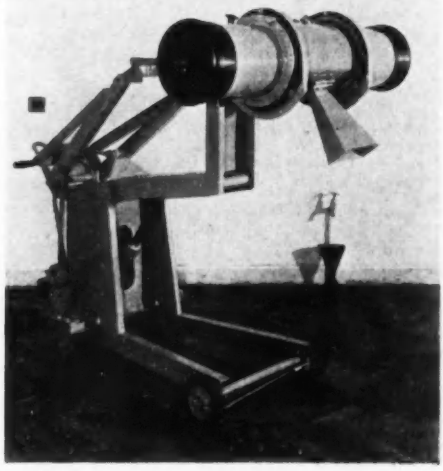
The unit proper is cylindrical in form, and is sub-divided internally by two insulating partitions. The h.v. source comprises two specially-designed transformers, each developing 100 kVp to earth. The transformers, together with the X-ray tube, are oil immersed, the tube being housed in the central compartment. They are directly connected to the tube in series, an additional filament heating transformer being provided on the cathode side. The tube, with a continuous rating of 200 kVp 10 mA, acts as its own rectifier, and there are no valves or h.t. cables.

The X-ray beam emerges from a window in the wall of the container. The anode of the tube is water cooled; an internal water duct also cooling the oil.

The control unit is of very small dimensions and designed to facilitate easy transport. Reproducible operating conditions are made possible by means of a mains compensator. A protective circuit prevents the apparatus from being switched on or alternatively it is switched off automatically if for any reason the water supply should be interrupted. For use in shipyards and on outdoor structures, the X-ray head is provided with slings so that it can be used quite independently of any other form of mounting. For such work the cylindrical form of the tube head permits of easy passage through a manhole.

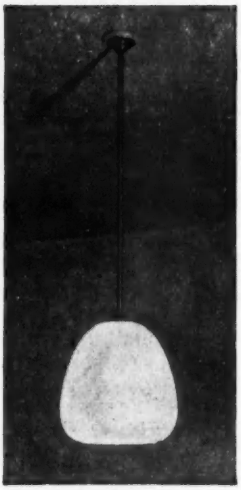
The "Compactix" unit, it is stated, has a radiographic penetration of three inches of steel in an economical exposure time, and operates from a single phase 220/250 V supply.

Philips "Compactix" unit



New Pendant Fitting for Schools

A NEW pendant fitting introduced by The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, is primarily for lighting in schools, but will be found suitable for many other applications. The metalwork is finished "real bronze" colour or chromium plate, and carries a white opal globe, 11 ins. in diameter. A cadmium plated louvre, designed to rest in the base of the globe, can be supplied if required. The fitting will take an e.s. lamp up to 200 W. It measures 36 ins. in length overall, and is available with ceiling plates having fixing holes suitable either for small or large B.S. boxes.



Smart yet efficient is the new G.E.C. fitting

Price Changes

THORN ELECTRICAL INDUSTRIES LTD., 105-109 Judd Street, London W.C.1, are among latest firms to announce increases in the price of their goods.

"Mary Ann" irons, as from May 1 will cost more. The type "M" (a.c.) iron, which was 39s. 6d., is now two guineas. The type "L" (a.c./d.c.), formerly 42s., is increased by three shillings.

RICHARD ALLAN RADIO LTD., Bafflette House, Batley, Yorkshire, also announce recent increases in prices of their loudspeakers, loudspeaker chassis and gramophone record players. These are incorporated in the revised price list effective as from April 23.

GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, also have announced revised prices effective from April 16. The D.M. 340 floor polisher is now £19 10s. plus £9 15s. 0d., the D.M.370 electric cleaner (only), £16 16s. plus £8 8s., and attachments (no change), £3 3s. plus 15s. 9d., whilst the D.M.H. 51 refrigerator now costs £89 0s. 0d. plus £46 5s. 7d.

Evershed's Process Control Instruments

EVERSHED AND VIGNOLES LTD., Acton Lane Works, Chiswick, W.4, have recently introduced a completely new range of process control instruments applicable to the oil industry, chemical works, steelworks, and other manufacturing concerns. The new instruments which operate on the Evershed electronic repeater system facilitate considerable flexibility of layout and have the advantage that control is effected without time lag over almost unlimited distances.

The Evershed process controller is an electronic equipment providing proportional or three term (i.e. proportional, integral and derivative) forms of control. It is used in conjunction with any standard transmitter operating on the Evershed electronic repeater system. This transmits a small d.c. current signal through a recorder or indicator to the controller which exercises control over a final element, usually an Evershed electro-pneumatic relay accurately positioning an air-operated valve. The Evershed circular chart recorder has been specifically developed for use with this apparatus.

The new Evershed "Rollflow" meter—a transmitting type flowmeter—is an addition to the existing series of electronic repeater transmitters which already incorporates instruments for liquid levels, pressures, tank contents and electrical quantities. It provides both local and distant indication of liquid or steam flow and can be used with process controllers, or as an independent unit in water undertakings and industrial plant. Several different types of high level alarm for storage tanks have also been developed, and are now being placed on the market.

TRADE PUBLICATIONS

SWITCHGEAR. The protection of distribution points on medium voltage systems can be safely left to the range of combination fuse switchboards available by the English Electric Co., Ltd., Queens House, Kingsway, London W.C.2. A brochure is now available which gives details of the range.

CAPACITORS. A. H. Hunt Ltd., Bendon Valley, Garratt Lane, Wandsworth, London S.W.18, have now issued their latest service trade catalogue available to the trade.

VIBRATORS. Now available from the Plessey Co., Ltd., Ilford, Essex, is a well-produced brochure dealing with the range of precision-built vibrators which the company produce.

BATTERIES. Catalogue V. Home 12th edition, for all types of Exide Ironclad batteries for traction has now been issued by Chloride Batteries Ltd., Clifton Junction, nr. Manchester, Lancs.

HANDLAMPS. Just issued by Britannia Batteries, Ltd., 66 Victoria Street, London S.W.1, is a leaflet giving full details of the Alklum handlamps.

RUBBER CUSHIONING. "Torque," the development journal of Silentbloc, Ltd., and the Andre Rubber Co., Ltd., Victoria Gardens, Ladbroke Road, Notting Hill Gate, London W.11, focuses this month on "Silentbloc" development in the textiles industry.

REPLACEMENT ELEMENTS. List No. ALJ/27, issued by Metway Electrical Industries, Ltd., King Street, Brighton, gives details of the many types of replaceable kettle and immersion heater replacements available from the company.

Electrical Equipment for the "OCEAN MONARCH"

ELECTRICITY is used on a lavish scale in the 13,000 ton Furness Withy luxury liner *Ocean Monarch* built by Vickers-Armstrongs at Newcastle and shortly to be commissioned. Much of the equipment, including lighting in the public rooms, electric cooking equipment in the main and crew's galleys, passenger lifts, sound equipment, telephones, fire alarms, motor-starting equipment, and luminous call equipment has been supplied by the General Electric Co., Ltd.

Lighting for the public rooms utilises a blend of cold-cathode fluorescent and tungsten lamps, and more than half a mile of cold-cathode tubing has been installed, the predominating colours being gold and warm white. There are more than 1,000 tungsten lamps disposed in fittings from 6 in. to 6 ft. in diameter, and in all, 44 special fittings were designed for the various public rooms.

Power for the cold cathode lighting is provided by two 40 kVA 230 V motor alternator sets, one being a standby.

Decorative lighting in the smoke room

Galley Equipment

Main cooking equipment comprises a 10-oven island range, with Monel interiors and sheathed wire elements, each oven being surmounted by four 12 in. by 8 in. hotplates. A bain-marie, and hot cupboard are located at the end of the range. Other equipment in the main galley comprises three hot cupboards each 11 ft. 6 in. long, water boilers, griddle plates and a salamander. Grilling and fish-frying equipment are located in the grill-room and fish kitchen, while the bakery is provided with a double deck baking oven and double deck pastry oven, both arranged for steam injection. Additional material includes mixers, potato peelers, dough kneaders, etc., and a two-oven range for the crew's galley.

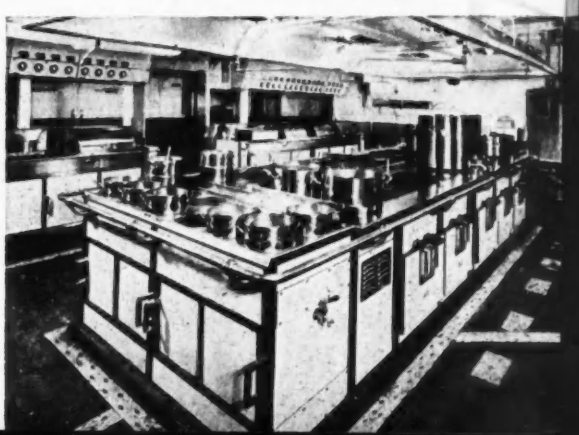
Motor starting gear in the engine room

Multiple Starters

Auxiliary motors in the engine room ranging from an 11 h.p. lubricating oil pump to the 85 h.p. main circulating pumps are controlled by a 15-panel plural starting equipment using a common starter (with standby duplicate) for sequential starting of groups of motors, this system having been adopted with success in previous Furness Withy ships.

Other equipment includes two passenger lifts, one engineer's lift, stores and pantry lifts, supplied by the Express Lift Co., an associate company. The sound equipment, believed to be the most comprehensive installed in a passenger vessel, comprises 120 loud speakers, and there is a 320-line telephone exchange in addition to a fire alarm system with 22 alarm points, and an extensive luminous call system.

Cooking equipment in the main galley



THE WEEK

COMMERCE *in news* INDUSTRY

Fuel Efficiency in Scotland

THE basis of a 10-year plan of campaign for industrial and household fuel efficiency in Scotland has been agreed upon by the Scottish Fuel Efficiency Committee. Under the plan the committee will advise on the application of measures promoting economy and efficiency in the use and consumption of fuel and power, and survey the progress of organisations established for that purpose.

The committee will also consider over-all plans for Scotland, including the co-ordination of the nationalised boards for coal, electricity and gas, and closer co-operation with the Scottish Board for Industry, Scottish Council, Coal Utilisation Joint Council and the Department of Scientific and Industrial Research. Consideration will also be given to such matters as the utilisation of low grades of fuel for electricity generation, curtailment of domestic demands on electricity and gas during winter peak hours, and the keeping of local authorities up to scratch in the installation of approved appliances. A women's committee will co-ordinate domestic ideas and services regarding solid fuel, electricity and gas, and a sub-committee on education is to promote and encourage a better knowledge of fuel efficiency and fuel technology.

Seaside Illuminations

THE Minister of Fuel and Power has written to the all-party holiday and resorts committee of M.P.s informing them that the fuel situation during September and October is expected to permit seaside illuminations. The letter added that daylight saving arrangements end on October 21 and it may be necessary after that date to introduce some restrictions and appeal for co-operation in restricting consumption during the evening peak load period.

A.M.D.E.A.'s New Trading Code

A DETAILED trading code covering terms and conditions applicable to all distributors of electric heating pads and blankets has been completed. The code, which became operative on April 1 is the outcome of a meeting of manufacturers of these products held under the auspices of the Associated Manufacturers of Domestic Electrical Appliances, in April, 1950. One of the main items in the code is the elimination of certain discounts, at one time offered to certain users including the medical profession. These discounts will in future be restricted to Hospital Management Committees. Another feature is the introduction of higher discounts to wholesalers during the summer. In this way it is hoped to encourage wholesalers to stock blankets and pads and help manufacturers to keep production flowing.

One of the problems peculiar to the electric pad and blanket industry is that the products are distributed largely through electro-medical channels and stores, and detailed Quantity Terms have therefore been introduced for all classes of retailer recognised by the code. The quantity terms schedule applies to all retailers in those trades as well as to all other retailers and Area Boards. The terms to contractors and retailers are as follows:

On Individual Orders	Tax Exclusive List Price Less
Up to £50	25%
£50-£100	25% and 2½%
£100-£250	25% and 5%
£250-£500	25% and 7½%
Over £500	25% and 10%

Manufacturers so far operating the code are H. J. Baldwin and Co., Ltd., Bestfrend Electrical Co., Ltd., Dowsing and Co., Ltd., Isopad Ltd., Leicester Battery Co., Ltd., Modern Electrical Industries (Northern) Ltd., Permaheat Ltd., Sutcliffe and Clarkson, Thermat Ltd., Thermega Ltd., Thermoelectric Ltd., Thermalux Ltd., and Warm-Glow Ltd.

Census on Electricity

ELECTRICITY consumers in Devon, Somerset and Bristol have not yet finished with census forms. Last week the S.W. Electricity Board distributed some 230,000 forms to its customers requesting answers to eight questions on accommodation. The object of this miniature census is to gather information which will assist the Board in preparing their standard domestic tariff. This is to be introduced throughout the area in the

The First Half-Century

The Wigan Electric Power Station was formally opened by the Mayor of Wigan on the 24th April, 1901. The Order was obtained in 1890, but no active steps were taken until 1895, when the Gas Committee instructed the gas engineer to prepare a scheme. The work, however, was never carried out and in 1898 it was decided to separate the Gas and Electric Committees. Mr. H. C. Bishop was appointed Engineer in March, 1899, and at once made a report advising the corporation to put down continuous-current plant.—*From our issue of May 9, 1901.*

summer, and will become operative on or about August 5. Full information in respect of Cornwall has already been obtained. As in the national census taken a month or two ago, the Board has assured its customers that all information given is strictly confidential, and will be used solely for working out the new charges. About 500,000 consumers in the area will be affected by the new standard tariff.

Radio Buoy

A NEW radio buoy, primarily for use with fishing fleets, has been manufactured by Radio Buoys and Beacons Ltd. Features of the buoy are a minimum endurance of 72 hours, readings of between five and 30 miles and a frequency of 1,901 k/cs. The mast light can perform one of two duties, giving either a flashing light three seconds on and six off continuously, or a light giving the same character at the same time as the transmitter is in operation. The transmitting cycle can be constant with a ratio of one unit for every six of silence, or alternatively the transmitter can be set so that transmission will begin at any time during the following week. Construction is sound and robust, and all parts have been treated against sea corrosion. An important point in its design is that the accumulator may be charged without being removed from the buoy.

Silver Jubilee in Two Cities

IN the spring of 1926 pioneer women in Manchester and Birmingham joined the newly formed movement for electrical education among women, which at that time was just two years old. Many of those pioneers were present at recent celebrations to mark the silver jubilee of the Manchester and Salford Districts and Birmingham and District branches of E.A.W. The festivities in the north extended over a week, beginning with a dinner at the Midland Hotel, and including visits to four large electrical factories and Kearsley power station. Among notable guests at the dinner were Dame Caroline Haslett, E.A.W. director, Sir Joseph Hallsworth, chairman N.W.E.B., Mr. H. F. Carpenter, secretary B.E.A., the Lord Mayor and Lady Mayoress of Manchester, and the Mayor and Mayoress of Salford.

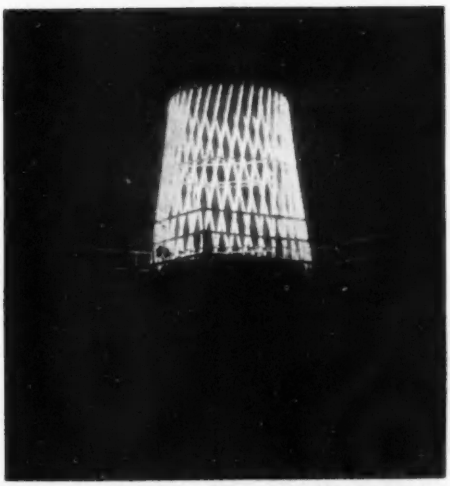
Birmingham branch celebrations took the form of a luncheon, and at this function guests included Lord Citrine, Dame Caroline Haslett and Lady Hacking (branch president).

Board issues £40,000 Writ

AT last week's meeting of Cardiff City Council it was announced that the S. Wales Electricity Board had issued a writ for £40,000 against Cardiff Corporation. We understand that the Board has claimed that this amount was due from the corporation for electricity supplied for the city's tramcars, trolley-buses, street lighting and public buildings. It represented the difference between the Board's present tariff demands and the cost of current charged by the corporation's own electricity undertaking. The council has decided not only to defend the writ but also to initiate proceedings in the Court of Chancery against the Central Authority.

New Beacon at London Airport

COLD cathode fluorescent tubes have been used in the new 7 kW identification beacon installed among navigational aids at London Airport. Designed and supplied by the G.E.C., the beacon gives a total light output from its 36 tubes of 180,000 lumens. The advantage of fluorescent over the plain discharge type lamp, usually used in the past, is the longer life and higher efficiency in terms of light output. Colour is controlled by using suitable fluorescent powder coating, and in the case of London Airport a green light is flashed. Four tubes in series are operated from each of nine transformers which are mounted on a platform immediately below the ceiling of the beacon hut so that the connections between transformers and tubes are kept as short as possible.



The new identification beacon installed at London Airport as seen at night

Scrap Metal Prices

THE Minister of Supply has made a new non-ferrous metals order which consolidates earlier orders, revises some maximum prices and provides for special prices for exceptional transactions. The new prices for those items which have been altered are as follows:

Secondary zinc alloy ingots	£177	Braziery copper ...	£156
No. 1 copper wire	£183	Lead cable sheathing	£147
Clean heavy copper	£178	Other lead scrap ...	£143
No. 2 copper wire	£173	Zinc alloy die-casting	£129
S.A.A. cases mechanically treated or fired		...	£173

Merchants will be allowed to charge a commission of 1½% on re-melted lead and to increase the maximum charge for bricquetting to £2 a ton. The maximum price for scrap not mentioned in the order may be fixed by agreement between the buyer and seller but the agreed price must not exceed the highest scheduled price for material in the same class.

Radio in Asia

DETAILED plans are now being laid for the International Radio and Electronics Exhibition to be held in Bombay between February 9 and 29, 1952. It is claimed to be the first of its kind and size to be staged in the East. Primary object will be to promote public interest in radio and electronics and it will not be planned as a trade fair. Although the major part of the open-air site will be devoted to radio, television and components, a fair proportion of space is to be allocated to electrical appliances, refrigeration equipment, lighting fittings and small generating plant. It has been decided that the exhibition will have four days—probably the final days—for buyers only. Goods of foreign manufacture are to be allowed to be imported by the Indian Government free of duty, provided they are for display purposes only. Organisers are the Radio and Electronic Society of India, who have established an office at 41 Kingsway, W.C.2.

Board Employees By-pass the Meter

FOUR employees of the Midlands Electricity Board, and the wife of another employee, were found guilty of fraudulently abstracting electricity, at Evesham last week, and fines and costs totalling over £70 were imposed. One of the defendants was a foreman meter inspector, others being an electrician, a meter reader and a charge-hand. Another employee, a mechanic, was also found guilty of a similar offence but judgment was deferred. The prosecution, it was stated, took a very serious view of the offences, for the defendants who were employees of the M.E.B. knew when meter readings occurred, with the result that they could remove the evidence that they were by-passing the meter. There had consequently been great difficulty in instituting the proceedings.

Century of Progress in the Home

UP and down the country during the next five months there will be large and small, world famous and local contributions towards the one great Festival of Britain. Many will have the years 1851 and 1951 as their theme, and one such exhibition will be at 35 Grosvenor Place, London, headquarters of E.A.W., which will undoubtedly be the venue of women the world over who are connected with the industry. At a simple ceremony last week the Dowager Lady Swaythling, president of E.A.W., officially opened the equally simple exhibition.

It is probably one of the smallest contributions to the Festival in the country, and consists of four sets of two cabinets, each set depicting the remarkable change that electricity has brought to the home in the past century. The kitchen, lounge and bedroom are shown with effective comparisons between the cooking range and modern electric cooker, wash tub and washing machine. The iron, radio, television and electric fire also illustrate the change-over. Perhaps the most striking feature of the displays is the atten-

A large export order completed recently by the English Electric Co., Ltd. was this 64,000 kVA transformer, here seen leaving the company's Stafford works on the first stage of its journey to Finland. The transformer has a ratio of 225/112·5/10·5 kV and is provided with ON/OFB type cooling and equipped with on load tap changing gear on 112·5 kV winding. The present shipment represents a contribution to Finnish re-equipment in the field of electrical generation following the disappearance of former installations behind the Iron Curtain

A remarkable similarity can be seen between this illustration and the winning display in London Electricity Board's display competition featured last week. This shows the Bude service centre, which won the S.W.E.B.'s competition and in both instances the playing card motif is prominent

tion to detail—even a boiled egg and egg-cup less than an inch high has found its place on the breakfast table. Displays were by Bell Display Ltd., of Bradford.

Displays in the South-west

RESULTS of the second window display competition organised by the S.W. Electricity Board were announced last week. Judges were said to have been particularly impressed by the ingenuity shown in presenting most effective displays within the limited budget of £5 allowed for accessories and trimmings. The Area Challenge Cup was won by the Bude service centre who gained an easy victory with a water heating motif. Truro's display of agricultural equipment, and Colston Avenue, Bristol's, of water heating, placed second and third, were praised especially for the manner in which they had been linked with local interest. In all, 101 displays were entered for the competition by 95 service centres throughout the area, and it was noticeable that small showrooms in the remote country districts responded to the challenge, and in many instances produced shows of a remarkably high standard. Besides the major awards, showrooms at Penzance, Lynton and Portishead were highly commended.

Power Cuts still With Us

IT is unfortunate that the advent of summertime did not free consumers from the scourge of electricity power cuts and we still receive reports of complaints expressed by various bodies. Not alone in their dissatisfaction is the S.E. Regional Board for Industry who, at the monthly meeting in London last week, expressed serious concern at the continuing cuts. The Board described as unreasonable the fact that load-shedding was taking place as late as May, and commented that the cuts had caused considerable loss of production to industry. It recommended that electricity generation be considered next in importance to coal regarding allocation of raw materials.

Social Functions

OUR miscellany of social functions this week includes a variety of activities. In keeping with the festival spirit and coincidental with the opening of Britain's great exhibition, the G.E.C. held their 1951 Drama Festival on Thursday, Friday and Saturday of last week. Teams from various G.E.C. works took part in the competition at Hirst Hall, Wembley, including Siemens & General Electric Railway Signal Co., Birmingham, the Witton factory and Swinton works at Mexborough. The canteen at Telcon's Greenwich factory was filled to capacity for the season's last open tournament staged by the firm's Amateur Boxing Club. Formed less than two years ago, the club is now firmly established and another three seasons should see a programme comprised solely of Telcon boxers.

A big day at the B.T.H.'s Rugby works was the recent Parents Day when nearly 200 parents of first-year apprentices availed themselves of the opportunity to see how their sons live and work. In the course of the day the guests visited the College of Technology and Arts, the hostel and the factory.

NEWS IN BRIEF

The Commissioners of Customs and Excise wish to point out that aquarium heaters which became chargeable at 66⅔% purchase tax in the 1951 Budget were those liable at 33⅓% under paragraph (a) of Group 12 of the Tax Schedule.

When power cuts affected lighting in the new House of Commons, the special Keepalite emergency equipment came into operation. Chloride Batteries Ltd. are proud of the successful performance of their equipment.

We hear that the Eastern Electricity Board's new tariff charges have been sent to the Area's Consultative Council for their observations and are expected to be published shortly.

N.W. Electricity Board is to build stores, offices and workshops at Newton Gate, Penrith.

A summer school on the Theory of Dielectrics will be held at the University of Liverpool from July 19 to 21. The school is being arranged by the University, the Institute of Physics and E.D.A. It will be followed by a conference on Dielectrics between July 23 and 25. Details of both can be obtained from the Institute of Physics, 47 Belgrave Square, S.W.1.

Copies of the annual report of the council of I.E.E. for the 1950-51 session and of the accounts for the year ended December 31, 1950, can now be obtained by members of the Institution on application to the secretary. Both will be presented at the annual meeting next Thursday.

Electric Supply News

Belfast

It is proposed to make application for sanction to borrow £500,000 to provide working capital for the corporation electricity undertaking. The undertaking is at present operating with a working capital of £200,000, but as a result of continued expansion and increases in costs this amount is now insufficient.

Birchills

Work is to begin soon on the fitting of devices to the cooling towers at the Birchills power station of the Midland Electricity Board, to avoid moisture nuisance in the area. Mushroom-shaped wood baffles will stand 10 ft. above the towers and have the effect of condensing the moisture-laden air, the water falling inside the tower.

Eire

A warning to consumers that a return to rationing would be inevitable unless strict economy was observed, was made recently by the Eire Electricity Supply Board. According to the Board's statement, 187,000,000 extra units had to be generated last year to cope with an unprecedented increase of 21% in consumption. The unusually wet summer last year made it possible for the hydro stations to achieve record output and to keep in step with the growing demand, but now, with the rising cost of coal, the use of current has been expanded "uncontrollably." Consumers are asked to reduce consumption between 9 a.m. and 6 p.m.

North of Scotland

The proposed Breadalbane scheme of the North of Scotland Hydro-electric Board has drawn protests from the Scottish Landowners' Federation. Members of the federation, at a meeting in Perth, pointed out that a substantial loss to agriculture would result both in the upper areas and lower areas, if the project was carried through. Concern was also expressed about the whole work of the board in relation to additional schemes which are understood to be under consideration for execution in the near future.

LIGHTING SCHEMES

Chester.—The City Council has decided to improve lighting in the main streets at a cost of £7,000.

Colyton.—The Parish Council has decided to undertake to bear the whole of the capital cost of the new street lighting scheme, which the South Western Electricity Board estimated would be about £750, and to ask Axminster Rural Council to raise a ten-year loan.

Dover.—The M.o.T. has approved the Rural District Council's scheme for street lighting in parts of the area.

Maidenhead.—Improvement in the lighting in the following roads, at a cost of £3,100, will be carried out if the Ministry of Transport give their approval: Norfolk Road, Cordwallis Road, Pinkneys Road, St. Marks Crescent, part of St. Marks Road, Courthouse Road, All Saints Avenue, Boyne Hill and part of Cox Green.

Southport.—Ministerial approval has now been given to Southport's scheme for improved electric lighting of Preston New Road, Liverpool Road to Woodvale, Union and Hill Streets, and Sussex Road.

Stoke Newington.—The B.C. is recommended to approve a scheme for improved lighting at Green Lanes, Seven Sisters Road and certain minor roads, at a cost of £17,704.

Wanstead-Woodford.—The Council is submitting to the M.o.T. for approval a scheme to improve street lighting, at a cost of £81,000.

Questions in Parliament

Television Relay

Replying to a question by Mr. Grey, the Postmaster-General, Mr. Ness Edwards, said several applications for licences for television wire broadcasting had been received, and he would discuss with representatives of the industry how far the development of relay services would fit in with the demands of the rearmament programme. Subsequently, he said that researches conducted to enable sound and television broadcasts to be available to telephone subscribers had not proceeded beyond the laboratory stage, and a system for conveying television over telephone subscribers' lines had not yet been devised.

B.E.A. or ?

When Mr. Gammans suggested that legislation should be introduced to change the name of either the British Electricity Authority or British European Airways, Mr. Noel-Baker stated that arrangements were made some time ago for the use of the full titles of the corporations where there might be misunderstanding.

V.H.F. Broadcasting System

Questioned about the plans for nation-wide broadcasting using the v.h.f. method, Mr. Ness Edwards, Postmaster-General, stated that the B.B.C. proposals for a frequency-modulated v.h.f. system were being examined. But the Television Advisory Committee had to be consulted, and he awaited their report as to whether either frequency modulation or amplitude modulation, only should be adopted or whether there should be a mixture of both.

Company Activities

Babcock and Wilcox

For 1950 the group profit is £1,651,771 after all charges, including U.K. tax of £2,820,628 (*£1,203,582*). This compares with a profit of £1,186,934 for the previous year. The 1950 figure includes unrequired provisions of £96,936 (*nil*), sundry capital profits of £11,768 (*£115,993*), and a transfer of £145,071 (*£100,000*) to tax equalisation reserve. There is a final Ordinary dividend of 10% plus cash bonus of 3%, payable on June 7, making 18% for the year. For 1949 there was a total of 15%. The parent company's net profit is £1,639,047 (*£1,182,498*). The sum of £650,000 (*£396,029*) is transferred to general reserve and £150,000 (*same*) to development reserve.

British Vacuum Cleaner and Engrg. Co.

Consolidated trading balance for the year to September 30, is £187,333 (*£106,691*), which includes £4,594 in respect of previous years. After charging depreciation etc., the profit, before taxation, is £136,295 (*£63,888*), less the proportion of subsidiary profits to independent shareholders £6,868. To U.K. tax £57,288 (*£27,767*), Canadian tax £13,652 (*£924*), pension reserve £10,000 (*nil*), and after payment of dividend there is £67,533 (*£43,272*) carried forward.

T. Clarke and Co.

The directors of this old electrical contracting firm announce a "rights" issue of 2s. Ordinary shares at 4s. on a one-for-four basis. The issue will amount to 154,538 shares.

Herbert Terry and Sons

Profit for 1950 is £96,330 (*£98,463*) after charging taxation of £124,599 (*£109,385*). Final Ordinary dividend is 10% plus bonus 2½%, making 17½% for the year. For 1949, there was an interim of 10% on £150,000 Ordinary capital and a final of 10% on the present capital as increased by 100% scrip bonus issue.

Hoover Ltd.

An application to the London Stock Exchange for a quotation for the 1,600,000 1s. "A" ordinary shares has been granted. These shares were created in 1947 and issued "to about 90 executives of the company at a crucial stage in the company's expansion as an incentive for them to carry the extraordinary demands arising during the launching of new products and the rapid extension of activities in export markets." Dealings began on Monday, quotations being around 25/3d.—25/9d.

Johnson and Phillips

Treasury consent has been received to a proposal to create 1,250,000 4½% Cumulative Redeemable Preference shares of £1 each (1971-91), and one million of them are now to be offered at par to Ordinary shareholders, on the basis of three Preference for every four Ordinary held. The directors are also proposing to create 666,250 additional £1 Ordinary shares, although there is no intention at the moment of issuing any of them. Mr. G. Leslie Waters, chairman, states that last December the company had a bank loan of £700,000. The business is steadily expanding. During the past five years over £600,000 has been ploughed back out of profits in addition to the £650,000 proceeds from the Ordinary share issue in 1946, and £280,302 capital profit on electricity nationalisation. About £300,000 will be needed in the next two or three years for the normal development programme now in hand. The group trading balance (other than the Scottish group) for 1950 is £504,833, as compared with £606,871 for the previous year. With other income added the total becomes £521,971 (*£622,958*).

Telephone Manufacturing Co.

For 1950, the group profit is £108,917 (against £127,449 for 1949), after allowing for all charges, including taxation. The sum of £128,998 (*£132,625*) is absorbed by taxation.

Telephone Rentals, Ltd.

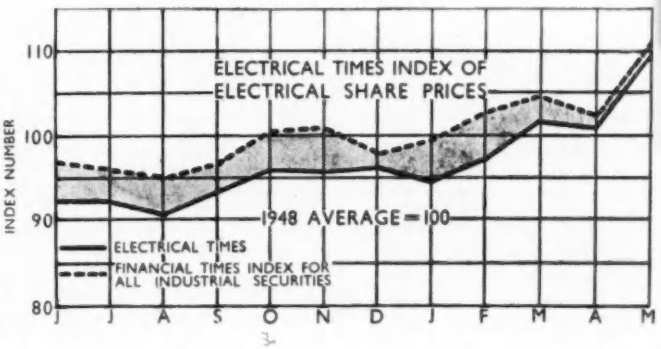
The group profit for 1950, after providing for all charges, including taxation, amounts to £239,236 (*£211,261*). Taxation charged is £235,766 (*£170,718*). Profit attributable to the holding company is £236,619 (*£209,461*).

Dividends Declared

Power Securities Corpn. Dividend of 6% (*same*).

Tube Investments Ltd. Interim ordinary dividend of 12½%.

The rearmament programme resulted in a sharp rise in electrical share prices during April. While the Electrical Times figure rose to 109.5, an increase of 8.3 over March, the Financial Times index for all industrial Ordinary shares also rose appreciably from 102.4 to 111.7. Figures are based on average prices ruling during 1948.



Commercial Information

CONTRACTS OPEN

HOME

May 14.—Edinburgh. Electrical installation at Glenlockhart. City Architect's Office, City Chambers.

May 14.—Manchester. Supply of electric lamps for central Purchasing Committee. General Manager, Corporation Transport Dept., 55 Piccadilly, Manchester 1.

May 14.—N. Ireland. Supply of electric floor polishers and sprayers to several hospitals under N.I. Tuberculosis Authority. William Harvey, secretary, 27 Adelaide St., Belfast.

May 15.—Sutton and Cheam T.C. Electrical installation in 52 houses to be erected in Danescourt Crescent. N. H. Michell, borough engineer and surveyor, Municipal Offices, High St., Sutton.

May 16.—Cork. Chain cutter and hollow chisel mortiser, sanding machine, tenoning machine and scriber, and cutter grinder, all fitted with electric motors suitable for 380 V a.c. P. Monahan, City Manager and Town Clerk, City Hall.

May 16.—Hull. Electrical installation at Paisley St. school. City Architect's Dept., Guildhall. Deposit £1 1s.

May 16.—Middlewich U.D.C. Electrical wiring of 56 houses being built on Chadwick Fields estate. Engineer's Dept., Victoria Building, Middlewich. Deposit £2 2s. (See May 3 issue.)

May 16.—Stepney. Three lifts and one ash hoist, all electrically operated, in connection with the flats being built in Vallance Rd. Borough Engineer and Surveyor, London Fruit Exchange, Duval St., Spitalfields, E.1.

May 18.—Ashton-in-Makerfield U.D.C. Supply and erection of 100 concrete columns and 100 lanterns, lamps, auxiliary gear and wiring for Class A street lighting on trunk road A.49. Surveyor, Town Hall.

May 18.—St. Albans (Herts) R.D.C. Provision and installation of 31 sodium vapour lighting units in High St., Redbourn, including supply and erection of concrete columns, lanterns, auxiliary equipment and wiring. Surveyor, C. Huskinson, 43 Upper Lattimore Rd., St. Albans.

May 19.—Slough T.C. Supply, erection and installation of 61 concrete columns, lanterns, 80 W mercury vapour lamps and equipment in Group B. Borough Engineer, Town Hall. Deposit £2 2s.

May 19.—Southwick U.D.C. Installation of street lighting on Ridgeway housing estate. Engineer and Surveyor, Town Hall, Southwick, Sussex. Deposit £2 2s.

May 20.—Grantown-on-Spey T.C. Electrical work in construction of five double blocks of houses. Applications by above date to A. Cattanach, Architect, Kingussie.

May 21.—Coseley U.D.C. Supply and erection 35 250 W mercury vapour lighting units and concrete columns on Birmingham-Wolverhampton Rd. J. C. Roper, Clerk of the Council, Council House. Deposit £2 2s.

May 21.—Cuckfield U.D.C. Installation of electric lighting and power circuits in 74 houses at Haywards Heath and Cuckfield. Housing Manager, Council Offices, "Maxwelton," Boltro Rd., Haywards Heath.

May 21.—N. Ireland. Electrical installation in 45 houses at Broughs Lane for N.I. Housing Trust. Offices of Trust are at 12 Hope St., Belfast. Deposit 10s.

May 21.—Southport T.C. Electrical work at No. 69 Albert Rd. Borough Architect and Town Planning Officer, Pavilion Buildings, Lord St.

May 22.—Leslie T.C. Electrical work in erection of 32 houses on Prinlaws site. Applications to A. D. Haxton and Watson, architects, Leven.

May 24.—Longbenton U.D.C. Electrical installations in dwellings under the following four contracts: 48 houses at Forest Hall; 23 houses on Fordley Estate; 14 old persons' homes and recreation room at Burradon; and 7 houses at Forest Hall. R. E. Sweetman, Engineer and Surveyor, Council Offices, Forest Hall, Newcastle-on-Tyne. Deposit £2 2s.

May 25.—Belfast. Supply and erection of 33 kV 1,500 MVA open type indoor switchgear of the airblast or small oil volume type. Merz and McLellan, Carliol House, Newcastle-on-Tyne 1. Deposit £5 5s. (See April 12 issue.)

May 25.—Belfast. Supply and erection of carbon dioxide fire extinguishing equipment for electrical substations. Also of 6,600 V compound filled armour clad switchgear of 250 MVA capacity, during period from July 1 to March 31, 1952. Electricity Dept., East Bridge St. Deposit in respect of first mentioned, £2 2s. (See May 3 issue.)

May 25.—Sheffield. Electrical installation at Totley Hall college of housecraft. W. Geo. Davies, City Architect, Town Hall, Sheffield 1. Deposit £2.

May 26.—Swansea T.C. Electrical installation in 44 houses at Penlan. Applications by above date to Borough Architect, The Guildhall. Deposit £2 2s. (See May 3 issue.)

May 28.—Metropolitan Water Board. Supply and erection of two self-cleansing electrically-driven rotary screens at Chingford (Essex) pumping station. Chief Engineer to Board, New River Head, Rosebery Av., E.C.1. Deposit £1 1s.

May 28.—Sowerby Bridge U.D.C. Supply and erection of 58 street lighting columns, lanterns, cut-outs, etc. Alfred Womersley, Clerk of the Council, 23 Wharf St., Deposit £2 2s. (Advertised in this issue.)

May 28.—Staines U.D.C. Installation of electricity in 94 houses on Worple Ave. estate. Work includes wiring, lighting points, switches, 5 and 15 amps points. Engineer and Surveyor, Shortwood House, 240 London Rd. Deposit £2 2s. (Advertised in this issue.)

May 29.—Belfast. Supply of electrically illuminated traffic signs. Executive Officers' Dept., Police Committee, 84 Chichester St., Belfast.

May 30.—Cork. Supply and installation of vehicle-actuated traffic signals at junctions of Grand Parade and Washington St., Main St., and Washington St., and Langford Row and Infirmary Rd. Tenders to P.

Monahan, City Manager and Town Clerk, City Hall.

May 30.—Northampton R.D.C. Electrical installation in 96 houses now being built. R. J. Miller, architect, 1 Cheyne Walk.

June 4.—Durham. Supply of sundry laboratory and workshop machinery and equipment for Stockton-on-Tees technical college, including electrical engineering motors, generators, transformers and instruments, electricians' tools and equipment and electric welding equipment. Applications to A. A. Denholm, Director of Education, Shire Hall, Durham.

June 9.—Leeds. Manufacture, supply and erection of following equipment for pumping station at Knostrop sewage works: one 6·6 kV, 400 A, 150 MVA switchboard; one 2 kV, 400 A, 50 MVA switchboard; one ·415/·346 kV, 2,000 A, 25 MVA switchboard; two 1,000 kVA, 6·6/2·0 kV transformers and two 500 kVA, 6·6/·415/·346 kVA transformers. Sewerage Engineer's Office, Civic Hall, Leeds 1. Deposit £5.

June 11.—Worthing T.C. Rewiring of electric circuits in approximately 130 houses on S. Farm estate. Borough Engineer and Surveyor, Town Hall. Deposit £3 3s.

June 16.—St. Neots U.D.C. Supply and erection of 26 concrete columns, one wall-mounting bracket, 27 lanterns with 140W sodium lamps, auxiliary equipment and wiring for street lighting on Ipswich-Weedon trunk road, A45. L. Henderson, clerk of the council, Council Offices, Huntingdon St., St. Neots, Hunts. Deposit £2 2s. (Advertised in this issue.)

June 25.—Coventry. Electrical installation at Whitley Abbey E.S.N. school. Applications to W. L. Chinn, Director of Education, Education Offices, The Council House, Coventry, by May 31. Deposit £2 2s.

June 26.—Galway. Electrical installation in new regional general hospital at Galway. Work covers mains and switchgear, lighting, service plugs, etc. Consulting engineers, J. A. Kenny and Partners, 44 Kildare St., Dublin C.17. Deposit £26 5s.

No date stated.—Buckie (Banff). Electrical work in erection of police station. Applications to W. R. Wark, County Architect, 13 Cluny Sq., Buckie.

No date stated.—Guildford T.C. Electrical installation to 156 houses at Bushey Hill, Merrow. Borough Engineer and Surveyor, Municipal Offices, High St.

No date stated.—Midlothian. Electrical work in four houses at West Calder. County Architect, 32 Palmerston Place, Edinburgh 12.

No date stated.—Tranent. Electrical work in erection of 3 shops and 2 houses at Coalgate Park. Names should be submitted to Town Clerk, Tranent.

OVERSEAS

*Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.*

May 24.—Wellington (N.Z.) Supply of moving coil type d.c. ammeters, flush pattern, suitable for mounting on a ferrous panel ¼" to ⅜" thick. Ranges and sizes as follows: 0–1 amps 10, 0–5 amps 125, 0–10 amps 90, 0–25 amps 36, 0–50 amps 50, 0–75 amps 6, 0–100 amps 3. Tenders to Director General (Stores Div.) G.P.O., Wellington C.1. Envelopes endorsed "Quotation for P & T 150/4354."

May 28.—Uruguay. Administracion Nacional de Combustibles, Alcohol y Portland, invite tenders for starter electromagnetically operated (with board for remote control of starting and stopping) for asynchronic motor with rotor in short circuit of 50 h.p. 220 V. B.o.T. (Ref. CRE (1B) 74262/50).*

May 29.—Wellington (N.Z.) Supply of 36 miles of textile-covered, lead sheathed telephone cable and 2 miles of enamelled, double silk and wool covered, tinned cable. Director-General (Stores Division), G.P.O., Wellington, C.1.

May 31.—French West Africa. Supply of 4 transformers for the Bobo-Dionlasso power station. Specifications from Public Works Dept., Ministere de la France d'Outre-Mer, Paris. B.o.T. (Ref. CRE (1B) 60025/51)*.

May 31.—Portuguese E. Africa. One 90 V, 4·5 kW d.c. generator and one 120 V monophase 2·5/3 kW a.c. generator required by Permanent Purchasing Commission, Treasury Dept., Lourenco Marques, on behalf of Lycieum Salazar. B.o.T. (Ref. CRE (1B) 59944/51).*

June 7—Sydney. Supply of 660 V multi-core control cable of asbestos and varnished cambric insulated, lead alloy sheathed and basket-wire armoured type, for Pyrmont B and Bunnerong B power stations. General Manager, Sydney C.C., Queen Victoria Buildings, George St., Sydney.

July 11.—Brisbane. Supply and delivery of two 1,000 kVA, 10,500/415/240 V oil immersed and natural cooling type, distribution transformers, for State Electricity Commission of Queensland. B.o.T. (Ref. CRE (1B) 59998/51).*

Your Queries — Answered

"Lico" plugs and sockets, makers of? T.E.—London Instrument Co., Ltd., Newnham Mill, Cambridge. (20126)

"Harrison" pattern fused line taps, makers of? M.B. Electric Street Lighting Apparatus Co., Jewry Lane, White Horse Lane, Canterbury. (20132)

"National Utility" vacuum cleaners, suppliers of? J.F. —National Utilities Ltd., 8 South King St., Manchester 2. (20139)

"Culinaire" food mixers, suppliers of? C.A.—L. G. Hawkins and Co., Ltd., 30-35 Drury Lane, W.C.2. (20146)

Radioactive static eliminators, suppliers of? J.T.—Isotope Developments Ltd., 120 Moorgate, E.C.2. (20157)

"Neogram" signs, makers of? H.C.—Neogram Ltd. Terminal House, London S.W.1. (20162)

Combined air cooling, purification etc. device, makers of? N.E.—E.C.D. Ltd., Tonbridge, Kent. (20176)

The above are selected from questions we have answered this week. If you have a query, send it to us.

ANSWERS WANTED

General Pump Co., address of? H.H. (20182)

Universal sewing machine motor, No. 11199, makers of? J.G. (20197)

June 12.—Pakistan. Supply of 20,000 dry batteries. Commercial Secretary, Supply and Stores Dept., 40 Lowndes Sq., S.W.1. Deposit 5s. Quote ref: PR 9930/PAJ. (Advertised in this issue.)

July 17.—Wellington (N.Z.). Supply and delivery of 8 110 kV 1,500 MVA and 10 110 kV 1,000 MVA circuit-breakers and accessories for State Hydro-Electric Dept. Deposit £100.

CONTRACTS PLACED

B.E.A. Bulk order for low pressure valves, J. Blakeborough and Sons Ltd.; 132 kV 3,500 MVA switchgear for Tilbury power station, Metropolitan-Vickers Electrical Co. Ltd.; Coal handling plant for Doncaster power station, Mitchell Engineering Ltd.; Boiler plant for Huddersfield power station Bennis Combustion Ltd.; Boiler feed pumps for Portobello power station, G. and J. Weir Ltd.; 132 kV 1,500 MVA switchgear for Worthing substation, English Electric Co. Ltd.; 132kV switchhouse for Carmarthen Bay substation, Balfour Beatty and Co. Ltd.; 132 kV overhead line between Doncaster and West Melton, Watsham's Ltd.; and 132 kV overhead line between Uskmouth and Llantarnam, Balfour Beatty and Co. Ltd.

Bedworth U.D.C. Supply of electric lamps for period April 1 to March 31, 1952, Thorn Electrical Industries Ltd.

Dudley T.C. Street lighting along Birmingham — Wolverhampton trunk road, A.4123, Revo Electric, £3,349.

Ilford T.C. Electrical work at Newington Park school, B. Winters and Son, Ltd., £2,549.

Rotherham T.C. Equipment for 95 street lamps for scheme in Broom Lane, Broom Valley Rd., and Brunswick Rd., G.E.C. Ltd., £3,571.

TRADE NOTES

E.W.F. Recently elected a member of the Electrical Wholesalers Federation is E. A. Wood Ltd., 100 Aston Road, Birmingham.

Eire Imports. The number of electric filament lamps which may be imported into Eire for household use from June 1 until November 30 has now been fixed at 50,000.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday night)

	£ s. d.	New York price
COPPER, electrolytic	210 0 0	£196 0 0
LEAD, good soft pig (foreign)	160 0 0	136 0 0
„ „ „ "English" quality	161 10 0	
TIN (99-99.75%) ... ...(Cash)	1135-1145	—
„ (3 months)	1115-1120	—
ALUMINIUM, commercial purity (del.) ...	124 0 0	—
ZINC	160 0 0	140 0 0
ARMOURING:		
Galv. Steel Wire (0·104 in.)	47 10 0	—
Mild Steel Tape (0·04 in.)	26 10 0	—

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Voluntary Liquidation

Lauray Electrical Co. Ltd., Tait Street, E.1, electrical contractors. At meeting of creditors statement of affairs submitted showing liabilities of £2,790. Assets were £346, thus revealing a deficiency so far as the creditors were concerned of £2,444. As regards members, there was total deficiency of £2,944. Resolution was passed confirming voluntary liquidation, Charles Boulton, accountant, of Station Chambers, East Finchley, N.2, was appointed liquidator, to whom particulars should be sent by May 25.

New-Era Domestic Products Ltd. Resolution for winding-up passed at a meeting on April 5. Stanley Jack, of 25 Newman St., W.1, appointed liquidator.

Underwood (Electric) Ltd., electrical wholesalers, Gt. Portland St., W.1. At statutory meeting of creditors statement of affairs, as at March 31, 1951, was submitted disclosing liabilities of £50,810, of which £25,633 was due to the debenture holder; £24,884 to trade creditors; and £293 in respect of accrued expenses. Assets estimated to produce £23,000, and after allowing £2,567 for preferential claims there were net assets of £20,433, thus leaving deficiency of £30,377. So far as shareholders were concerned, there was total deficiency of £54,377. Since the creditors' informal meeting last November the Receiver continued the London business for a few months in the hope of effecting a beneficial sale as a going concern, and arrangements had now been made for the sale of the stock and effects by auction. Shareholders had passed a provisional resolution for voluntary liquidation. After brief discussion, resolution passed adjourning creditors' meeting *sine die*, thus leaving way open for any possible sale of business.

Appointment of Liquidator

London. Peerless Refrigeration Ltd., Park Lane, W.1. David Morgan, Grosvenor Sq., W.1, appointed liquidator with committee of inspection.

Intended Dividends

London. D. G. Hall and Co. Ltd., Newport. Last day for receiving proofs, May 16. Joint liquidators are L. S. Findlay and H. S. Browning, of 35 Windsor Place, Cardiff.

London. Comuniphone Ltd., 8-10 N. Audley St., W.1. Last day for receiving proofs, May 17. Liquidator is Kenneth R. Cork,

London. Harrison and Co. (Electrical) Ltd., Broad St. Place, E.C.2. Last day for receiving proofs, May 19. Liquidator is A. E. Attwood, 20-21 Lawrence Lane, Cheapside, E.C.2.

Dividends

London. Ward Electrical Engineering Ltd., Wardour St., W.1. First and final dividends of 1s. 6d. in £ payable at offices of A. E. Attwood, 20-21 Lawrence Lane, Cheapside, E.C.2, on May 21.

BANKRUPTCY ACTS

Intended Dividends

Lincoln. Clarence Welbourn, electrical engineer and contractor, trading at 158 Hykeham Rd., Lincoln. Last day for receiving proofs, May 16. Trustee is G. H. Kelsey, 340 High St., Lincoln.

Receiving Order

Wandsworth. Richard Kendall, electrical dealer of 66 Sheen Rd., Richmond. Date of receiving order, May 1.

BUSINESS PROSPECTS

HOME

Adwick (Yorks) U.D.C. It is proposed to erect 146 houses at Woodlands and 70 at Carcroft at total cost of £301,342.

Ashby-de-la-Zouch R.D.C. Plans approved for erection of 40 houses at Oakthorpe and 78 at Measham.

Atcham (Salop) R.D.C. Approval received for erection of 40 houses at Ford and 4 at Cruckton.

Battersea. Dyneley, Luker and Moore, architects, 1 Lincoln's Inn Fields, W.C.2, have received permission for erection of warehouses and offices in Nine Elms Lane for T. and W. Farmiloe, Ltd.

Berwick. Old people's hostel is to be erected at Tweedmouth. County Architect is W. W. Tasker, County Hall, Newcastle.

Bingley (Yorks) U.D.C. Waddington and Moore, Ltd., Bradford, plan to build a textile factory at Crossflats. Also, tenders to be invited for erection of 30 houses at Bingley and 10 each at Cullingworth and Wilsden.

Blackburn. E.C. recommended to spend £25,000 on reorganisation of Technical College textile department.

Blyth T.C. Erection of shops at Belside has been proposed. Estimated cost, £3,000.

Brighton T.C. Erection of 86 houses at Coldean, and 9 in Hereford St., estimated to cost £107,540 and £11,250 resp. Also erection of old people's home on Lower Bevendean estate.

Chesterfield T.C. Erection of 73 houses on the Newbold estate. Borough Engineer and Surveyor, Town Hall.

Clogher R.D.C. Construction of 44 houses at Aughnacloy, Co. Tyrone. J. P. Rush, Architect, Market Sq., Dungannon.

Coventry. Council recommended to approve erection of 108 flats on Sadler Rd. site.

Darlington T.C. Plans approved for erection of 138 houses and 14 flats on Haughton South site and 20 houses in Nickstream Lane.

Ealing T.C. Layout approved for 108 flats at Northolt.

Esher U.D.C. It is proposed to install traffic lights in High St.

Exeter. N. Devon Regional Hospital Board is planning the erection of a hospital in the area.

Hazel Grove and Bramhall U.D.C. Erection of houses in two groups of 40 each at Bosden Ford Rd., and Hazel Grove. E. E. Capper, Clerk of the Council.

Hexham R.D.C. Contracts to be let shortly for erection of 10 houses at Newborough, 8 at Allandale and 14 at Ovingham.

Hinckley (Leics.) U.D.C. Plans approved for blocks of shops and flats on both the Mill Lane and Sketchley estates.

Huntingdonshire. A home for old people is to be built in north of county, at estimated cost of £21,660.

Kidderminster. Textile Co. proposes to build a factory in Springfield Lane.

Lambeth. Approval received for stage 1 development of site in Studley Rd. providing for 424 dwellings, 18 shops and maintenance buildings. Architects are Sir Lancelot Keay, Duckett and Partners, 80 Wimpole St., W.1.

Leicester. Council proposes to build two junior schools at estimated cost of £109,000.

Lisburn R.D.C. Erection of 32 flats and 24 houses at Lambeg, and 16 houses at Glenary. Architects, Gamble and Maxwell, 5 University Terr., Belfast.

Litherland U.D.C. Fifteen shops and 30 flats being built in Kirkstone Rd. North. Architects are Quiggin and Gee, Hall St., Liverpool 3.

London. A new day college at Holloway and installation of new boilers and electric supply at the Northern Polytechnic are among proposals submitted to the Minister by the L.C.C. education commttee.

Matlock (Derby) U.D.C. Sanction received to erect bus station in Bakewell Road.

Mold U.D.C. Construction of 51 houses on Bromley estate. Council's Architect, F. C. Roberts, Earl Chambers, Mold.

Newcastle - on - Tyne. Sub-branch library to be built on Blakelaw estate. City Architect, 18 Cloth Market.

Offaly. Erection of 26 houses at Portarlington. D. A. Tyndall, Chartered Architect, 43 Fitzwilliam Place, Dublin.

Oldbury T.C. 92 houses to be built on Brandhall estate.

Plymouth. Plans approved for first three storeys of a technical school in Cobourg St. at estimated cost of £150,000.

Rotherham T.C. Construction of 20 houses at Catcliffe and 16 at Brinsworth. Separate contracts. Council's Architects, Taylor Knight and Co., Brooksmoor House, Grove Rd., Moorgate, Rotherham.

Rothwell (Yorks) U.D.C. Erection of 28 houses on Lawrence Villa estate, Woodlesford. Council's Architect, Civic Buildings.

Shropshire. Colleges for further education are to be built at Oswestry and Wellington. Estimated costs are £38,000 and £570,000 respectively.

South Cambridgeshire R.D.C. Erection of 18 houses on Melbourn site. Council's Architect, County Hall, Hobson St., Cambridge.

St. Helens T.C. Erection of 26 bungalows on site at Queensway. M. Ward, Borough Engineer, Town Hall.

Stokesley (Yorks.) R.D.C. to erect a council chamber. Work expected to start in July.

Teddington. Church and school hall are to be built in Stanley Rd. at estimated cost of £35,000. Architects are H. and H. M. Lidbetter, 2 Verulam Buildings, W.C.1.

Tenterden T.C. Erection of 16 houses and a block of 4 flats in Appledore Rd. W. Lynn-Thompson, Council's Architect, The Ingles, Hawkhurst, Kent.

Tregaron R.D.C. Erection of 24 houses at Pontrhydfendigaid. W. S. P. Cottrell, Architect, 8 Quay St., Carmarthen.

Twickenham T.C. recommended to approve improvements to electrical installation at technical college. Estimated cost, £2,039.

Tyrone. Erection of maternity and child welfare clinic at Clogher. Quantity Surveyors, McCarthy and Lilburn, Scottish Provident Buildings, Belfast.

Willenhall (Staffs.) E.C. proposes to erect a £134,000 secondary school.

Wortley (Yorks) R.D.C. Erection of a block of shops and flats at Grenoside. Husband and Co., 388 Glossop Rd., Sheffield 10.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

Armin Bandor Ltd., 85 Langford court, St. John's Wood, N.W.8. Manufacturers of and dealers in wireless, television and electrical goods, etc. Cap.: £100. Dirs.: N. Tuchmann and Mrs. C. Tuchmann.

Ayers, Jardine Ltd., 26/8 Hallam St., Portland Place, W.1. General, heating, ventilating, lighting, mechanical, electrical, radio, motor, marine, refrigerating, constructional and consulting engineers, etc. Cap.: £3,000. Dirs.: to be appointed by subs. Subs.: H. W. Jardine and J. P. Dinning.

Harry Bibby and Co., 26 Buttermarket St., Warrington. To take over business of electrical engineers and contractors carried on as "Harry Bibby and Co." at Warrington. Cap.: £15,000. Dirs.: H. Horrocks, Margery Rimmer and J. H. Rimmer.

G. E. Collinge and Co. Ltd., Beehive Mill, Portwood, Stockport. Electricians, radio and television and radar and electrical engineers, etc. Cap.: £100. Dirs.: F. M. de Bass and Mrs. M. de Bass, and Mrs. E. Collinge.

Grove Electronics Ltd. Radio, television, electrical and research engineers, etc. Cap.: £500. Dirs.: not named. Subs.: C. C. Nicholas, 37 Burr ham Ct., W.2, and Rosalind Roberts, 99 Raglan Ct., Wembley Park, Middx.

Industrial Chain Supply Co. Ltd., 6 Broad St. Place, E.C.2. Civil, mechanical, electrical and hydraulic engineers, manufacturers and distributors of and dealers in transmission, elevating and conveying chains, etc. Cap.: £1,000. Dirs.: E. R. Shandon and A. J. Adams.

J. A. Prestwich Indu stries Ltd. To acquire the whole or not less than 90% of the issued share capitals of J. A. Prestwich and Co. Ltd., and Pencils Ltd., mechanical and electrical engineers, manufacturers of motors, cycles, etc. Cap.: £100. Dirs.: to be appointed by subs. Subs.: H. Chinnery and J. F. Gallaher, 16 Coleman St., E.C.2.

Prosser's Electrical Co. Ltd. To take over business of an electrical engineer carried on at 110 Dale End, Birmingham, by Laurence H. Prosser, etc. Cap.: £1,000. Dirs.: Not named. Subs.: L. H. Prosser and Mrs. M. Prosser.

Radar, Radio and Television Ltd., 26 Oakleigh Rd. South, New Southgate, N.11. To take over business carried on at 26 Oakleigh Rd. South, and 384 Bowes Rd., New Southgate, N.11, by Louis Freedman. Cap.: £2,000. Dirs.: L. I. Freedman and Mrs. W. Freedman.

S. Richard and Co. (Liverpool) Ltd., 7a The Temple, Dale St., Liverpool 2. Wireless, television, telephonic and telegraphic engineers, etc. Cap.: £4,000. Dirs.: S. Richard and Annie Richard.

Richmond Time Recording Ltd., 50 Howard St., Birmingham 19. Manufacturers of and dealers in time-recording machines and apparatus, etc. Cap.: £2,000. Dirs.: G. F. Crighton and E. J. Darlaston.

Rusmor Ltd., 9/11 Copthall Av., E.C.2. Engineers and assemblers, mechanical, electrical or otherwise, steel construction, etc. Cap.: £100. Dirs.: K. P. Morritt and E. S. Cogan.

H. L. Service Ltd., 26 Freshfields Av., Upminster, Essex. Wireless, television and electrical engineers and contractors, servicers, repairers, etc. Cap.: £100. Dirs.: W. E. Hobbs and Elsie D. Lines.

Sound Diffusion (Holdings) Ltd., Durcraft Works, Franklin Rd., Portslade, Sussex. Manufacturers of and dealers in automatic and other telephones, telegraphs, wires, cables, lines and appliances of all kinds, etc. Cap.: £1,000. Dir.: C. P. Stonor.

True-Vue (York) Ltd., 48 Stonegate, York. Radio, television, electrical and general engineers, etc. Cap.: £100. Dirs.: G. Goodall and J. Holroyd.

Unit Electrical Installation Co., Ltd., 3 High St., Wednesfield, Staffs. To take over business carried on as "The Unit Electrical Installation Co." at Wednesfield. Cap.: £3,000. Dirs.: H. Evans, Fanny E. Evans, L. Warwick and Marjorie Warwick.

Wallington Electric Ltd., 169 Stafford Rd., Wallington, Surrey. Manufacturers of and dealers in electrical and other equipment and appliances, etc. Cap.: £1,500. Dirs.: S. G. Burdick and Avice M. Burdick, Geraldine C. M. Prendergast, and L. F. Barter.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Acousticon. 692,779. Class 9. Electrical deaf-aid intruments and apparatus and loud speakers, sound amplifiers etc., all being part of such deaf-aids. General Acoustics Ltd., 6/10, Douglas St., S.W.1.

Antiference. 686,097. Class 9. Radio and television aerials; plugs and sockets and radio interference suppressors. Antiference Ltd., 67 Bryanston St., W.1.

Dynalog. B683,661. Class 9. Electronic measuring instruments Foxboro-Yoxall Ltd., Lombard Rd., Merton, S.W.19.

Velva-Glow. 696,459. Fluorescent lighting signs. Nightingale Products (Blackburn) Ltd., 12, Nightingale St., Blackburn.

Iconotron. 693,676. Class 9. Pick-up tubes. iconoscopes, monoscopes and image-converter tubes, etc. Cathodean Ltd., Meadowcroft Laboratories, Church St., Cambridge.

Rally. 695,745. Class 8. Electric shaving instruments, etc. Jonas Ake Gregorius Malmberg, Nordenskoldsgatan 86, Stockholm, Sweden.

Westone-Reed. 696,660. Class 9. Projection screens. Western Electric Co. Ltd., Liberty House, Regent St., W.1.

MEETINGS TO NOTE

THURSDAY, MAY 10

I.E.S. (Leicester Centre).—Annual meeting at E.M.E.B., Charles St., 6.30 p.m.

FRIDAY, MAY 11

A.S.E.E. (Crewe Branch).—"Motors and Control Gear." Crewe Arms Hotel, 7.30 p.m.

WEDNESDAY, MAY 16

PURCHASING OFFICERS ASSOC. (Slough Branch).—Lecture on manufacture of cables, to be arranged by St. Helen's Cable and Rubber Co., Ltd. Reindeer Hotel, 7.15 p.m.

THURSDAY, MAY 17

I.E.E. (London).—Annual meeting at Savoy Place, 5.30 p.m.

FRIDAY, MAY 18

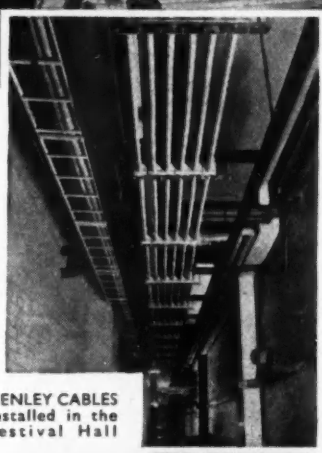
I.E.E. (Education Discussion Circle).—Questions Night. Savoy Place, 6 p.m.

SATURDAY, MAY 19

A.S.E.E. (Oxford Branch).—"Neon Sign, estimating, erection and maintenance by Contractors." H. Langdon-Down. S.E.B., George St., 3 p.m.

PURCHASING OFFICERS ASSOC.—One-day conference at N. British Station Hotel, Edinburgh.

Royal Festival Hall



HENLEY CABLES installed in the Festival Hall

The paper cables for all sub-mains and heavy power circuits, and the V.R. cables for sub-circuit wiring, were all HENLEY. In addition HENLEY P.V.C. wires were used for the Sound Amplification, Signalling and Cueing Systems.

Electrical Installation by

THE BERKELEY ELECTRICAL ENGINEERING COMPANY LTD

VINCENT SQUARE, LONDON, S.W.1

Architect to the London County Council :
Robert H. Matthew, A.R.I.B.A.

Chief Engineer :
J. Rawlinson, M.Inst.C.E., M.I.Mech.E., M.I.M. & Cy.E.

HENLEY CABLES

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD
51-53, HATTON GARDEN, LONDON, E.C.1

BY APPOINTMENT ELECTRIC CABLE MANUFACTURERS

No. 3 . . . Portable Instruments

Representative of Weston portable instruments, is the Model S.103 — a moving iron type of instrument, designed for a wide range of measurements to first grade accuracy on both A.C. and D.C. The 6" scale is linear over the whole of its working range and a knife-edge pointer and anti-parallax mirror are provided to facilitate accurate reading. The instrument is supplied as a Milliammeter, Ammeter or Voltmeter. Full details of the Model S.103 and of the Model S.82—available in D.C., A.C. rectifier and thermocouple types, are available on request.

WESTON
Electrical Measuring Instruments

SANGAMO WESTON LIMITED

Enfield, Middlesex. *Tel: Enfield 3434 (6 lines) and 1242 (4 lines).* *Grams: Sanwest, Enfield*

Branches:
Glasgow, Manchester, Newcastle-on-Tyne, Leeds, Liverpool, Wolverhampton, Nottingham, Bristol, Southampton, Brighton

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 35s. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

ST. NEOTS URBAN DISTRICT COUNCIL

IPSWICH—WEEDON TRUNK ROAD A.45
STREET LIGHTING IMPROVEMENT

TENDERS are invited for the installation of new street lighting to Group A standard along a section of the above mentioned road in St. Neots, extending from the River Bridge to Green End, a distance of approximately 1,048 yards. The works include the supply and erection of:

(*a*) 26 reinforced concrete columns,
(*b*) 1 wall mounting bracket and
(*c*) 27 lanterns with 140 watt Sodium discharge lamps complete with all auxiliary equipment and wiring.

Plans and general conditions of contract may be inspected and specification, bill of quantities and form of tender obtained from the undersigned upon payment of a deposit of £2 2s. returnable on receipt of a bona-fide tender.

Tenders in plain sealed envelopes endorsed "Street Lighting" must be forwarded to the undersigned not later than Saturday, June 16 next.

The council do not bind themselves to accept the lowest or any tender.

L. HENDERSON,
Clerk of the Council.

Council Offices, Huntingdon Street, St. Neots, Hunts.
May 2, 1951 (K 623)

STAINES URBAN DISTRICT COUNCIL

Worple Avenue Estate

INSTALLATION OF ELECTRICITY

TENDERS are invited from experienced firms for the installation of electricity in 94 existing houses on the Worple Avenue Estate, Staines. The work includes for providing all the necessary wiring, lighting points, switches, 5 amp and 15 amp points together with all incidental works.

A specification together with schedule of points, etc. and form of tender may be obtained on application to the Engineer and Surveyor, Engineer and Surveyor's Department, Shortwood House, 240 London Road, Staines, upon payment of a deposit of 2 gns., which will be returned upon receipt of a bona-fide tender not subsequently withdrawn.

Tenders must be enclosed in the envelope endorsed "Worple Avenue Estate" and delivered to the undersigned by 5 p.m. on Monday, May 28, 1951. The envelope must not bear any name or mark indicating the identity of the sender.

The Council do not bind themselves to accept the lowest or any tender.

F. ENTWISTLE,
Clerk of the Council.

Council Offices, 29 Clarence Street,
Staines, Middlesex. (K 653)

COUNTY BOROUGH OF PRESTON

Education Committee

NEW ELECTRICAL INSTALLATION
ROEBUCK STREET COUNTY PRIMARY SCHOOL

TENDERS are invited from electrical contractors for the work in connection with the above.

Contractors desirous of tendering should apply for drawings and specification to the Borough Engineer and Surveyor, Municipal Building, Preston, within seven days of this notice, forwarding a list of similar works carried out and a deposit of £1 1s. (cheques to be made payable to the "Corporation of Preston").

The work is to be carried out before the school's summer holidays, and contractors should state in their application whether they can supply the necessary labour and material. (K 614)

COUNTY BOROUGH OF SWANSEA

44 Houses at Penlan

TENDERS FOR ELECTRICAL INSTALLATION

ELECTRICAL engineers wishing to tender for the ELECTRICAL INSTALLATION for 44 houses at Penlan are invited to submit their applications to the Borough Architect, The Guildhall, Swansea, on or before May 26, 1951.

Plans, specification and conditions of contract will be forwarded on application and deposit of £2, provided applicant gives satisfactory evidence of having previously carried out work of a similar character.

The deposit will be refunded after delivery of a bona-fide tender (which is not subsequently withdrawn) and the return of all documents.

No guarantee is given that the lowest or any other tender will be accepted.

T. B. BOWEN,
Town Clerk.

The Guildhall, Swansea.
April 30, 1951. (K 608)

SOWERBY BRIDGE URBAN DISTRICT COUNCIL

STREET LIGHTING DEPARTMENT

TENDERS are invited for the supply and erection of 58 street lighting columns, lanterns, cut-outs, etc., including wiring from lamp holders to cut-outs; also one catenary set including lantern and wiring.

Specifications, bills of quantities and form of tender will be supplied to applicants enclosing fee of 2 gns., which fee will be reimbursed on receipt of a bona-fide tender. Tenders to be enclosed in envelopes provided and returned to the undersigned not later than May 28, 1951.

ALFRED WOMERSLEY,
Clerk of the Council.

23 Wharf Street,
Sowerby Bridge. (K 652)

THE HIGH COMMISSIONER FOR PAKISTAN

INVITES tenders for the supply of BATTERIES, DRY, 20,000.

Forms of tender, which are returnable by June 12, 1951, may be obtained from the Commercial Secretary, Supply and Stores Department, 40 Lowndes Square, London S.W.1, between the hours of 10 a.m. and 4 p.m. Mondays to Fridays, on payment of a fee of 5s. (not returnable) per tender. The reference PR 9930/PAJ should be quoted on all applications for tender forms. (K 613)

APPOINTMENTS VACANT

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following positions in District 348 (Cardiff West) in the Central Sub-Area of the Board:—

(*a*) ASSISTANT ENGINEER, Underground Mains.
(*b*) ASSISTANT ENGINEER, Overhead Lines.

Preference will be given to applicants who possess the Higher National Certificate or its equivalent, or have passed the Graduateship Examinations of the Institution of Electrical Engineers.

The salary for the positions will be in accordance with Class "D", Grade 9 (£494-£502-£510) of the National Joint Board Schedule for the Electricity Supply Industry.

Applications stating, specifically whether applying for (*a*) or (*b*), and giving age, present position, present salary, qualifications and experience, and whether married or single, together with the names and addresses of three referees, should be addressed to the Secretary (Establishments), The South Wales Electricity Board, St. Mellons, Cardiff, so as to reach him not later than May 23, 1951.

D. G. DODDS,
Secretary.
(K 667)

EASTERN ELECTRICITY BOARD

Norfolk Sub-Area

APPLICATIONS are invited for the following appointments:

King's Lynn District

FIRST ASSISTANT DISTRICT ENGINEER

Applicants should have had a sound technical training and wide experience in the planning, construction, operation and maintenance of h.v. and l.v. overhead and underground systems, including substations, preferably in rural areas. Corporate membership of the Institution of Electrical Engineers will be an advantage.

The salary for the post will be in accordance with Class "E," Grade 5, of the National Joint Board Salary Agreement commencing at £662 per annum.

Applications, stating age, education, technical qualifications and experience, with details of present appoint ment and salary, should be addressed to the District Manager, King's Lynn and Western District, Eastern Electricity Board, Gaywood Bridge, Wootton Road, King's Lynn, Norfolk.

Suffolk Sub-Area

Walton-on-the Naze, Clacton District

ELECTRICITY SERVICE MANAGER

Applicants should have had experience of organisation and management, and also extensive experience in all the commercial activities pertaining to a branch office, including contracting and the running of a service centre, and be thoroughly competent to advise consumers on the utilisation of electricity. They should also be competent to carry out certain engineering duties not exceeding the erection and maintenance of l.v. services (principally overhead) and, subject to instruction, switching operation of l.v. and h.v. distribution networks.

The provisional annual salary for this appointment will be £560.

Applications, stating age, education, qualifications and experience, with details of present appointment and salary should be addressed to the District Manager, Clacton District, Eastern Electricity Board, Town Hall, Clacton, Essex.

Both future salaries and conditions of service for these appointments will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme, and may be required to undergo a medical examination.

Applications should be addressed to the person concerned so as to reach him within fourteen days of the appearance of this advertisement. (K 664)

BRITISH ELECTRICITY AUTHORITY

London Division

ASSISTANT MECHANICAL REPAIRS ENGINEERS—BARKING GENERATING STATION

APPLICATIONS are invited for these appointments to assist in the supervision and progressing of mechanical repairs to large boiler and turbine plants. Applicants should have served an engineering apprenticeship, and have had good practical experience, including the handling of men. Technical training and qualifications will be an advantage.

Salary in accordance with National Joint Board Schedule, Class "M," Grade 9, i.e. £819 per annum inclusive of London allowance. The posts are superannuable in accordance with the B.E.A. and Area Boards' superannuation scheme.

Applications, stating age, qualifications and experience to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, to be received within 14 days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(K 627)

ELECTRICAL POWER ENGINEERS' ASSOCIATION

APPOINTMENT OF ASSISTANT SECRETARY

THE National Executive Council of the Electrical Power Engineers' Association invites applications for the appointment of an Assistant Secretary.

Applicants should be under 45 years of age and it would be an advantage to have had experience in the electricity supply industry, preferably on the technical side.

The successful applicant will be required to operate in the Midlands area of the Association and to reside in or near Birmingham.

The commencing salary will be £750, rising, by three annual increments of £50, to £900.

In the first instance, application for fuller particulars of the appointment should be made to the undersigned not later than May 26.

J. F. WALLACE,
General Secretary.

102 St. George's Square,
London S.W.1. (K 622)

WAR DEPARTMENT

APPLICATIONS are invited for the following vacancies in the Fortifications and Works Directorate at Chessington, Surrey:—

1. SENIOR DRAUGHTSMAN (ELECTRICAL)

Applicants must be in possession of the Higher National Certificate in Electrical Engineering or equivalent. Must have good experience in practical electrical engineering, not less than five years experience in the preparation and checking of drawings of each of the following types, and be able to take charge of a drawing office producing drawings for:—

(i) Complete layout for electrical power and lighting of a large building.

(ii) Transmission and distribution network including substation design and layout.

(iii) Complete a.c. switchboard including alternator, feeder and synchronising panels.

Applicants should also be capable of supervising the preparation of schedules of quantities for electrical installation drawings.

Applicants for the following posts must have reached a technical standard of not less than Ordinary National Certificate:—

2. LEADING DRAUGHTSMAN (ELECTRICAL)

Must have experience in preparation of distribution and transmission diagrams and drawings, substation and main switchboard layouts, and knowledge of latest regulations for electrical equipment of buildings and British Standard Codes of Practice.

3. DRAUGHTSMAN (ELECTRICAL)

Must have good knowledge and experience of electrical engineering.

Candidates for all posts should be under 50 years of age.

Salaries for the posts are:—

Post 1, £645-£785 per annum
Post 2, £540-£645 per annum.
Post 3, £320-£545 per annum.

Starting salary will be fixed according to age, qualifications and experience. Annual increases are payable, subject to satisfactory service.

The posts are temporary but most of them have long term possibilities and open competitions are held periodically to fill established posts.

The work is varied and interesting and good canteen facilities exist.

Apply, in writing only, stating age, nationality and full details of qualifications and experience to the War Office (C.5(A)), Room 504, Northumberland House, Northumberland Avenue, London W.C.2. (K 629)

ADMIRALTY

VACANCIES exist for PRODUCTION INSPECTORS at various Admiralty Establishments and in shipbuilding and industrial centres in various parts of the country. The duties involve work in connection with the manufacture, inspection, test and installation of a wide variety of mechanical and electrical equipment for H.M. Ships. For certain of the posts experience of electronic, including radar, apparatus will be advantageous.

Candidates, who must be at least 25, should have served a recognised engineering apprenticeship or have had equivalent training, followed by at least three years' relevant experience in industry or Government service. They should preferably be in possession of Higher National Certificate or equivalent: a lower qualification such as Ordinary National Certificate might, however, be considered. Appointments will be unestablished, but there may be opportunities at a later date of competing for permanent posts. The salary scale is £570 by £20 to £675 per annum and entry will be at the minimum, subject to a deduction of £20 for each year by which the age of entry falls short of 30. Rates outside London are a little lower. Write, quoting D33/51-A, to the Ministry of Labour and National Service, Technical and Scientific Register (K), York House, Kingsway, London W.C.2, for application form which must be returned completed by June 14, 1951. (K 649)

NORTH WESTERN ELECTRICITY BOARD

No. 3 Sub-Area

APPOINTMENT OF METER TESTERS

APPLICATIONS are invited for the appointment of Meter Testers in the Sub-Area Testing Station at Tame Valley Works, Stalybridge.

The terms and conditions of employment will be in accordance with those laid down by the National Joint Industrial Council for the Electricity Supply Industry, the present rate of pay being 36.5d. per hour (£6 13s. 10d. for a 44-hour 5-day week).

Candidates should preferably have had experience in the calibration and testing of various types of electricity meters both a.c. and d.c., but applicants who have had experience in repairing meters, instruments and other small electro-mechanical equipment will be considered.

Applications, stating age, present post, experience and education, should be received by E. Binns, Esq., M.I.Mech.E., A.M.I.E.E., Sub-Area Manager, The North Western Electricity Board, No. 3 Sub-Area Headquarters, Union Street, Oldham, not later than Saturday, May 19, 1951. (K 662)

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Lanarkshire Sub-Area

APPLICATIONS are invited from suitably qualified engineers for the under-noted appointments:

1. SECOND ASSISTANT ENGINEER (CONSTRUCTION), Sub-Area Headquarters.

Applicants, who should be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications, should have a sound engineering training followed by a wide experience in construction of 11 kV and 33 kV Underground and Overhead Distribution Systems including indoor and outdoor substations and general construction work.

2. GENERAL ASSISTANT ENGINEER (OPERATION AND MAINTENANCE), Sub-Area Headquarters.

Applicants, who should be Graduates of the Institution of Electrical Engineers, or hold equivalent qualifications, are required to have had a sound engineering training with subsequent experience in the operation of a large Underground and Overhead H.V. and L.V. Distribution System. They should be conversant with short-circuit calculations, load flow diagrams and voltage-drop calculations.

3. SECOND ASSISTANT DISTRICT ENGINEER, Lanark District.

Applicants, who should be Graduates of the Institution of Electrical Engineers or hold equivalent qualifications are required to have had a sound engineering training and subsequent experience with both Underground and Overhead H.V. and L.V. Distribution Systems, including the maintenance and operation of H.V. and L.V. switchgear, fault location on H.V. and L.V. cables and testing of protection gear.

The salary and conditions of service will be in accordance with the National Joint Board Agreement, Schedule A, the present classification and grading is:

1. SECOND ASSISTANT ENGINEER (CONSTRUCTION) Class "K," Grade 7, salary £786/£822 per annum.
2. GENERAL ASSISTANT ENGINEER (OPERATION AND MAINTENANCE) Class "K," Grade 13, salary £515/£537 per annum.
3. SECOND ASSISTANT DISTRICT ENGINEER, Lanark District Class "E," Grade 7, salary £579/£609 per annum.

The salaries are subject to the statutory deductions including superannuation and successful candidates will require to reside within a reasonable distance of their respective offices, which for appointments 1 and 2 will be Sub-Area Offices, Hamilton, and for appointment 3, District Office, Lanark. Applications, stating age, education, training, experience, qualifications and present position should be forwarded to the undersigned, endorsed "Appointment 1, 2 or 3", within 14 days of the date of this advertisement.

DUGALD SMITH,
Manager.

137 Almada Street,
Hamilton. (K 647)

NORTH EASTERN GAS BOARD

Head Office, Leeds

APPLICATIONS are invited for the following positions:

ELECTRICAL ENGINEER

Open to Engineering Graduates or Corporate Members of the Institution of Electrical Engineers, at a commencing salary of £1,000-£1,200, the point of entry to be determined by qualifications and experience.

The successful candidate will be required to carry out electrical investigations and to be responsible for the preparation of electrical development schemes at the various Works of the Board.

Candidates must have a sound academic background and have had a wide experience in the layout and installation of electrical equipment in works or factories. Preference will be given to candidates with both drawing office and practical workshop experience.

ELECTRICAL SUPERVISOR

The commencing salary will be within Grade A.P.T. 12 of the National Salary Scales (£645-£770) the point of entry to be determined by qualifications and experience.

The successful candidate will be required to supervise the installation of electrical equipment and be responsible for assuring the necessary standard of electrical maintenance at the various Works of the Board.

Preference will be given to candidates of Higher National Certificate standard with a wide experience of electrical installations in large works or factories. Design ability is not essential, but a good knowledge of wiring diagrams and circuit testing, together with extensive workshop experience is necessary.

The successful candidates will be required to pass a medical examination and subscribe to such superannuation scheme as the Board may adopt.

Form of application may be obtained from the Chief Engineer at the address below, and should be returned, together with the names and addresses of two referees, not later than fourteen days after the date on which this advertisement appears.

J. C. GARDNER,
Secretary.

Bridge Street, Leeds 2.
May 3, 1951. (K 672)

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following appointments:—

ASSISTANT ELECTRICAL MAINTENANCE ENGINEER —WEST HAM GENERATING STATION.

Applicants should be thoroughly conversant with the maintenance of high tension switchgear, etc., low tension switchgear, generators, motors and control gear and other electrical plant associated with a power station.

Salary in accordance with revised N.J.B. Schedule, Class "G," Grade 9, plus London allowance, £599 11s. per annum.

SHIFT CHARGE ENGINEER—GROVE ROAD GENERATING STATION.

Candidates should have received a sound electrical and mechanical engineering training of National Certificate standard, and have had experience in the efficient operation and control on shift of high pressure boiler and turbine plant.

Salary in accordance with revised N.J.B. Schedule, Class "F," Grade 7, plus London allowance, £656 5s. per annum.

SHIFT CHARGE ENGINEER—DEPTFORD EAST GENERATING STATION

Candidates should have received a sound technical training in electrical and mechanical engineering, and have reached a recognised standard. Experience in the operation and efficient control of large electrical and mechanical power station plant is essential. Applicants should also have a successful record in the direction and control of man-power.

Salary in accordance with revised N.J.B. Schedule, Class "H," Grade 7, plus London Allowance, £728 12s. per annum.

SECOND ASSISTANT GENERATION (OPERATION) ENGINEER—GROUP 3.

Candidates must possess good technical qualifications and be familiar with the operational requirements of modern generating stations. A knowledge of the salary and wage agreements for the electricity supply industry would be an additional qualification.

The successful applicant will be required to assist the Group Generation Engineer (Operation) in matters relating to the control of a large group of stations.

Commencing salary with the range of £789 12s. to £929 4s. p.a. in accordance with revised N.J.B. Schedule, Class "AX," Grade 2, plus London allowance.

All the foregoing posts are superannuable.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, to be received within 14 days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(K 639)

BRITISH ELECTRICITY AUTHORITY

South Wales Division

APPLICATIONS are invited for the appointment of SHIFT CHARGE ENGINEER at Upper Boat Power Station, near Pontypridd at a salary in accordance with Class H Grade 7 (£692-£722 per annum) of the revised National Joint Board Agreement.

Applicants should preferably have obtained the Higher National Certificate and served a regular apprenticeship.

Previous operational experience in a modern generating station is essential

The appointment will be superannuable under the British Electricity Authority and Area Boards Scheme.

Forms of application may be obtained from the Divisional Secretary at the address below to whom completed applications should be returned not later than May 22, 1951.

H. V. PUGH,
Divisional Controller.

Cardiff (Pengam Moors) Airport,
Cardiff. (K 644)

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of ASSISTANT in the commercial department of District 342 (Bargoed and Blackwood) in the Central Sub-Area of the Board.

Applicants must have received sound engineering training and have had experience in the commercial operations of a district, and advising consumers.

The salary for the position will be in accordance with Class "E," Grade 9 (£519/£525/£531) of the National Joint Board Agreement for the Electricity Supply Industry.

Applications, stating age, present position, present salary, qualifications and experience, and whether married or single, together with the names and addresses of three referees, should be addressed to the Secretary (Establishments), The South Wales Electricity Board, St. Mellons, Cardiff, so as to reach him not later than May 23, 1951.

D. G. DODDS,
Secretary.
(K 666)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the following positions in the Drawing Office of the Chief Generation Engineer (Construction) at Wolverhampton:—

(*a*) SENIOR MECHANICAL DRAUGHTSMEN

Candidates should have a wide experience in the layout and design of (*a*) generating stations or (*b*) generating plant, including boilers, turbo-alternators and ancillary equipment.

Appointments will be made in the provisional salary ranges of £600-£700 and £500-£600 per annum, dependent upon qualifications and experience.

(*b*) ELECTRICAL DRAUGHTSMEN

Candidates should have a knowledge of the layout of generating stations, works switchgear and works systems.

The provisional salary will be in the range of £375-£475 per annum.

(*c*) CIVIL ENGINEERING DRAUGHTSMEN

(i) Candidates should have experience in the design of civil engineering and building works for generating stations, and reinforced concrete work.

Appointments will be made in the provisional salary ranges of £500-£600 per annum and £375-£475 per annum, dependent upon qualifications.

(ii) Candidates should have had a wide experience in the layout and design of heavy structural steelwork for generating stations.

Appointments will be made in the provisional salary ranges of £600-£700 and £500-£600 per annum, dependent upon qualifications.

(*d*) ARCHITECTURAL AND BUILDING DRAUGHTSMEN

Candidates should possess wide experience in the preparation of working drawings relating to power stations and other buildings.

The provisional salary will be in the range of £500-£600 per annum.

The salary ranges quoted are subject to negotiation with the appropriate organisation. The possession of an engineering degree or recognised qualification will be considered an advantage. Conditions of service and superannuation will be as approved by the British Electricity Authority.

Applications should be made on forms which may be obtained from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham, 13, and should be returned not later than May 26, 1951.

F. W. LAWTON,
Divisional Controller.
(K 671)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

SECTION ENGINEER, COVENTRY

APPLICATIONS are invited for the position of Section Engineer in the Transmission Department, to be located at Coventry.

Salary will be within Class AX/DX, Grade 4 of the Schedule C of the National Joint Board Agreement (£684-£890 per annum).

Candidates must have had experience in the maintenance and operation of 132 kV High Voltage overhead lines, outdoor transformer and switching stations in a Transmission Section and must be Corporate Members of the I.E.E.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, British Electricity House, Barker Gate, Nottingham, and should be returned not later than May 25, 1951.

W. S. BURGE,
Divisional Controller.
(K 673)

EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following appointment in the Chief Engineer's Department at Area Board Headquarters:—

SENIOR ASSISTANT ENGINEER (Construction)

Applicants should have had extensive experience in the design and construction of a large distribution system, including the preparation of specifications for plant and the selection of tenders.

Experience in the supervision of construction work up to and including 66 kV, both by direct labour and by contract, will be an advantage.

The salary will be in accordance with the National Joint Board Schedule, commencing in Class "AX," Grade 1, within the range of £884-£1,015 per annum and subsequently according to the classification of the Area which is at present Class "DX," £1,066-£1,106.

The possession of an engineering degree or similar qualification and Corporate Membership of the Institution of Electrical Engineers would be an advantage.

Applications should be forwarded to the Chief Engineer, The East Midlands Electricity Board, Mapperley Hall, Lucknow Avenue, Nottingham, to reach him not later than May 31, 1951.

P. H. DE KEYSER,
Secretary.
(K 648)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER, STAYTHORPE GENERATING STATION

APPLICATIONS are invited for the post of Assistant Shift Charge Engineer at Staythorpe Generating Station, near Newark, Notts.

The salary will be in accordance with Class "J," Grade 9, of the National Joint Board Agreement (£646-£674 per annum).

Applicants should have had a sound technical training with practical experience in the operation and control of modern generating plant.

The post will be superannuable within the terms and conditions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity House, Barker Gate, Nottingham, and returned not later than May 25, 1951.

W. S. BURGE,
Divisional Controller.
(K 674)

BRITISH ELECTRICITY AUTHORITY

SENIOR ASSISTANT SURVEYOR—ESTATES DEPARTMENT HEADQUARTERS, LONDON

BRITISH ELECTRICITY AUTHORITY require VALUATION SURVEYORS who are members of the Royal Institution of Chartered Surveyors or similar bodies.

The posts which are based on the Authority's headquarters in London are permanent and superannuable. The provisional salary range will be from £900—£1,200 p.a. inclusive of London allowance. The work is varied and interesting and will involve travel from time to time to all parts of the country.

Experience and a sound knowledge covering all classes of urban and rural property and estates management are required. Agricultural experience and a knowledge of the Town and Country Planning Acts and procedure are desirable qualifications.

Applications, stating age, qualifications, experience and present salary should be forwarded to D. Moffat, Esq., Director of Establishments, British Electricity Authority, British Electricity House, Great Portland Street, London W.1, so as to be received not later than May 21, 1951.

Please quote reference AE/169. (K 626)

BRITISH ELECTRICITY AUTHORITY

North-Eastern Division

APPOINTMENT OF GENERAL ASSISTANT ENGINEER ELECTRICAL PROTECTIVE GEAR AND TESTING SECTION TECHNICAL DEPARTMENT

APPLICATIONS are invited for the position of General Assistant Engineer in the Electrical Protective Gear Section of the Technical Department. Applicants should possess qualifications of Graduate I.E.E. standard and have had engineering works training. Experience of protective gear would be an advantage.

The salary for this appointment will be in accordance with Grade 8, Schedule "C" of the National Joint Board Agreement (£437-£604 per annum) and commence at a point commensurate with qualifications and experience.

Superannuation will be in accordance with the British Electricity Authority and Area Boards' Superannuation Scheme.

Forms of application may be obtained from the Divisional Secretary (Establishments), British Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne 1, to whom they should be returned to arrive not later than May 19, 1951. (K 600)

CARMARTHENSHIRE EDUCATION COMMITTEE

Llanelly Technical College

APPLICATIONS are invited for the post of FULL-TIME TEACHER OF ELECTRICAL ENGINEERING SUBJECTS, to commence duties in September, 1951.

Candidates should be graduates or hold equivalent qualifications with teaching and/or industrial experience.

The successful applicant will be required to teach Electrical Engineering Science in National Certificate Courses and probably electrical installation subjects in City and Guilds Courses.

Ability to teach some mathematics will be an advantage.

Salary in accordance with the provisions of the Burnham Scale of Salaries for Teachers in Technical Schools, with increments for previous teaching and/or industrial experience.

Application forms, which must be returned within two weeks of the appearance of this advertisement, may be obtained from the undersigned on receipt of a stamped addressed foolscap envelope.

IORWERTH HOWELLS,
Director of Education.

Education Department,
County Hall, Carmarthen. (K 560)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the appointment of SHIFT CHARGE ENGINEER at Wolverhampton Generating Station, Class "E", Grade 7, commencing salary £579 per annum.

Applicants should hold Higher National Certificate in electrical and mechanical engineering and should have had a sound technical training and practical experience in the control and operation of steam generating plant and main switchgear, or mechanical and electrical experience in a manufacturer's works. Qualified marine engineers with electrical experience would be considered suitable.

Salary and conditions of service will be in accordance with the N.J.B. Agreement, and superannuation under terms approved by the British Electricity Authority.

Applications should be made on forms, obtainable from the Divisional Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, and should be returned not later than May 26, 1951.

F. W. LAWTON,
Divisional Controller.
(K 670)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointment:

SHIFT CHARGE ENGINEER (Bedford Generating Station).

Salary in accordance with the N.J.B. Schedule A, Class "D," Grade 7 (£563-£573 per annum).

Applicants should have served an apprenticeship and obtained an Ordinary National Certificate in electrical and/or mechanical engineering, or equivalent, and possess experience in the operation of generating stations.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, stating age, experience and present position should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than May 18, 1951. Envelopes should be endorsed "Shift Charge Engineer—Bedford."

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (K 645)

SOUTHERN ELECTRICITY BOARD

APPLICATIONS are invited for the following posts:—

PLANNING ENGINEER

Heston District of No. 1 (Southall) Sub-Area.

Salary: N.J.B. Class "E," Grade 7, Column 1 (£607 19s. per annum, inclusive). N.J.B. conditions of service.

Candidates should have had experience in the preparation of proposals and estimates for extensions of h.v. and l.v. networks and substations operated at voltages up to and including 11 kV, and the ability to deal with the preparatory work prior to construction. They should have had a good technical training. Corporate membership of the I.E.E. would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 2-6 Windmill Lane, Southall, Middlesex, and returned to him not later than ten days after the appearance of this notice.

BRANCH COMMERCIAL SUPERINTENDENT

Devizes Branch, Melksham District of No. 2 (Newbury) Sub-Area.

Salary: N.J.B. Class "E," Grade 8, Column 1 (£550 per annum). N.J.B. conditions of service.

Qualifications will include a sound knowledge of the organisation and operation of the commerical side of electricity supply industry, particularly in relation to rural development, and a wide experience of all aspects of consumers service, including estimating for all types of wiring installations. Familiarity with the correct application of all types of tariff.

A Branch Commercial Superintendent is required to take complete charge of the branch office to which he is appointed.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Road, Newbury, and returned to him not later than ten days after the appearance of this notice.

INSTALLATION SUPERVISOR

Aldershot District of No. 3 (Portsmouth) Sub-Area.

Salary: N.J.B. Class "F," Grade 9 (£538-£549-£560 per annum). N.J.B. conditions of service.

Applicants must be capable of estimating for and supervising all types of electrical installation work. A thorough knowledge of the current edition of the I.E.E. Regulations and appropriate Factory and Home Office Regulations is essential. The person appointed must be capable of co-ordinating the installation work throughout the district.

(Continued in next column)

(Continued from previous column)

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him not later than ten days after the appearance of this notice.

The successful candidates for the above appointments will be required to contribute to the B.E.A. and Area Boards' superannuation scheme, if eligible.

F. W. KEMPTON,
Secretary.
(K 665)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the following positions at Ocker Hill Generating Station, Tipton, Staffordshire:—

(*a*) SHIFT CHARGE ENGINEER, Class "F," Grade 7, commencing salary £625 per annum.

(*b*) BOILER HOUSE SHIFT CHARGE ENGINEER, Class "F," Grade 9, commencing salary £538 per annum.

Candidates for (*a*) should hold Higher National Certificate in electrical and mechanical engineering, or an equivalent qualification, and should have had sound technical training and practical experience in the control and operation of steam generating plant and main switchgear, or mechanical and electrical experience in a manufacturer's works. Qualified marine engineers with electrical experience will receive consideration.

Candidates for (*b*) should possess Ordinary National Certificate in mechanical or electrical engineering, should have had sound technical training and considerable experience of combustion and the operation of h.p. boiler plant.

Conditions of service will be in accordance with the N.J.B. Agreement, and superannuation under terms approved by the British Electricity Authority.

Forms of application may be obtained from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be returned not later than May 19, 1951.

F. W. LAWTON,
Divisional Controller.
(K 615)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments in the Generation Construction Department at Divisional Headquarters:

SENIOR DRAUGHTSMEN (MECHANICAL)

The commencing salary will be within the range of £525-£735 per annum, according to age and experience.

Applicants should be in possession of the Higher National Certificate, or equivalent, and preferably have served a recognised apprenticeship course. They should be familiar with one or more of the following:

Generating station lay-out and design, coal handling plant, ash and dust-handling system and pipework systems.

The salary is provisional and will be subject to negotiation through the medium of the appropriate negotiating body.

The appointments will be superannuable in accordance with the British Electricity Authority and Area Board's Superannuation Scheme.

Applications, stating age, experience and present position, should be sent in envelopes endorsed "Senior Draughtsmen (Mechanical)", to arrive not later than May 26, 1951, to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14.

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (K 646)

BRITISH ELECTRICITY AUTHORITY

South East Scotland Division

APPLICATIONS are invited for the position of ASSISTANT SHIFT CHARGE ENGINEER, Class "H", Grade 9, of the Revised National Joint Board Schedule, at Portobello Power Station; commencing salary £609.

Candidates should preferably have experience of steam electric power plant including detailed working knowledge of the operation of steam turbo-generators, modern boiler plant and of high tension electrical switchgear. Certificated Engineers with extensive marine experience would also be considered.

Applicants will be subject to superannuation under the terms and conditions approved by the British Electricity Authority.

Applications, stating age and experience, should be addressed to the Divisional Controller, British Electricity Authority, South East Scotland Division, British Electricity House, Portobello, Midlothian, not later than seven days after the appearance of this advertisement.

J. F. FIELD,
Divisional Controller.
(K 663)

BRITISH ELECTRICITY AUTHORITY

GENERATION OPERATION BRANCH

APPLICATIONS are invited for the appointment of a SENIOR ASSISTANT ENGINEER in the Efficiency and Testing sub-branch of the generation operation branch of the chief engineer's department at headquarters in London.

Candidates must be fully conversant with power station operation, and preference will be given to those who have a knowledge of thermodynamics and who have been employed on testing power station plant. A knowledge of operation and testing of grit arresters and electrostatic precipitators would be an advantage.

A University degree or technical qualifications equivalent to corporate membership of either the I.E.E. or I.Mech.E. are essential.

The salary for the appointment, which is superannuable, will be within Grade 1 of the N.J.B. agreement, £912-£1,169 p.a., according to qualifications and experience, rising to a maximum of £1,235 p.a., including London allowance.

Applications, stating age, present salary and giving full details of qualifications and experience, should be forwarded to D. Moffat, Director of Establishments, British Electricity House, Great Portland Street, London, W.1, so as to be received not later than May 26, 1951.

Please quote reference AE/170. (K 669)

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of THIRD ASSISTANT ENGINEER (Mains Construction) in the Eastern Sub-Area of the Board based at Cwmbran, Monmouthshire.

Applicants should have experience in the construction of all types of overhead lines up to 66 kV and in the laying and jointing of cables up to 33 kV. They should also have experience in maintenance work and the organisation and control of labour.

Preference will be given to candidates who are suitably qualified technically and who possess the Higher National Certificate or its equivalent.

The salary for the position will be in accordance with Class "H", Grade 10 (£571-£584-£597) of the National Joint Board Schedule for the Electricity Supply Industry.

Applications, stating age, qualifications and experience, present position, present salary and whether married or single, together with the names and addresses of three referees, should be addressed to the Secretary (Establishments), The South Wales Electricity Board, St. Mellons Cardiff, so as to reach him not later than May 23, 1951.

D. G. DODDS,
Secretary.
(K 668)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

SENIOR ASSISTANT TO COAL PURCHASING OFFICER, DIVISIONAL H.Q.

APPLICATIONS are invited for the post of Senior Assistant to the Coal Purchasing Officer at Divisional Headquarters.

The successful candidate will be required to assist in the purchase of all solid fuels, and fuel oil, and in the arrangement of suitable transport from collieries to power stations, and should have a good knowledge of price and the chief characteristics of various types of coal.

Salary will be within Grade 6 of the N.J.C. Scales (£630 to £705 per annum).

The position will be superannuable within the provisions of the B.E.A. and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, and should be returned not later than May 25, 1951.

W. S. BURGE,
Divisional Controller.
(K 676)

LONDON ELECTRICITY BOARD

North Eastern Sub-Area

APPLICATIONS are invited for the following positions: ENGINEERING DRAUGHTSMAN (Ref. V.1231/T) at Stratford, E.15. Candidates should possess a wide experience in the design and modification of substations and other buildings, and ability to work on own initiative and deal with architects and surveyors. Salary from £500 per annum inclusive.

DRAUGHTSMAN (Ref. V.1230/T) at South Woodford, E.18. Applicants should be at least 21 years of age and have had a good general education and drawing office experience, preferably on Mains Records. Salary within range £300 to £500 per annum inclusive.

The salaries are provisional, pending grading of the posts under the National agreement of the appropriate negotiating body, and the commencing salaries will be determined according to qualifications and experience.

Application forms obtainable from Establishments Officer, 46 New Broad Street, E.C.2, to be returned duly completed within 10 days, quoting clearly the reference number of the vacancy for which application is made. Please enclose addressed foolscap envelope and quote relevant reference on all correspondence. (K 677)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

ARMATURE WINDER required in repair and rewind department. Excellent prospects and rates.—Max Arc and Electrics, Ltd., 190 Thornton Road, Croydon. (K 494)

ASSISTANT required for Sales Manager of progressive manufacturer of automatic control equipment. Successful candidate must have electrical engineering degree, and sound technical ability is more important than selling ability. Age 30/35. Salary approximately £1,000 per annum.—Send full particulars, tabulated and typewritten, with covering letter in own handwriting, to Box No. 5071, Electrical Times. (K 486)

BOWATER'S THAMES PAPER MILLS LIMITED, Northfleet, have a vacancy for a qualified ELECTRICAL DRAUGHTSMAN, and applications, giving age, experience and salary required, are invited. Preference will be given to those applicants having previous experience in this type of work. (K 665)

COST CLERK required. Must have had experience in preparation and rendering of final bills for electrical engineers.—Apply to the Secretary, Drake and Gorham (Contractors) Ltd., 36 Grosvenor Gardens, S.W.1, giving details of experience, age and salary required. (K 619)

CROMPTON PARKINSON LTD. require SENIOR ESTIMATOR for a.c. and d.c. rotating plant, etc.—Applications, with age and details of experience, should be addressed to the Manager, Plant Division, Severn Street, Birmingham 1. (K 618)

DESIGN DRAUGHTSMAN required to assist in the layout and design of cable supporting steelwork in power stations, substations, cable tunnels, etc., including the design of component parts for this purpose. Construction work in connection with cabling for transmission, distribution and generation is also necessary. The applicant should have a good knowledge of the strength of materials and preferably have had some workshop experience. Five day week. Pension fund.—Applications should be made in writing, to Staff Officer, British Insulated Callender's Construction Co. Ltd., 21 Bloomsbury Street, W.C.1. (K 630)

DRAKE AND GORHAM (CONTRACTORS) LTD. have a vacancy on their London staff for a SENIOR SUPERVISING ENGINEER. Must have had previous experience in a contractor's office. Apply to the Secretary, 36 Grosvenor Gardens, London, S.W.1, with details of education, experience, age and salary required. (K 562)

DRAUGHTSMEN required for all types of power cable installations, willing to train if necessary. Salary according to experience and qualifications. Write giving particulars, to Ref. 410 Siemens Brothers and Co., Ltd., Woolwich, S.E.18. (K 643)

ELECTRICAL DRAUGHTSMAN, familiar with light mechanisms or instruments and preferably with some circuit experience, required by Dowty Equipment, Ltd., Arle Court, Cheltenham, for their electrical development department. Age 21-25. Higher National Certificate preferred. The factory is ideally situated in the grounds of a country house and working conditions are excellent. Write to Personnel Manager, stating age, experience and salary required. (K 564)

ELECTRICAL DRAUGHTSMAN with technical qualifications and practical experience required for large paper mill in north west. Capable of preparing diagrams of new and existing installations and conversant with automatic control. Pension scheme available and good prospects of advancement.—Write, giving full particulars of previous experience to Box No. 6021, Electrical Times. (K 655)

FOR INDIA

AN old established and well-known company in India, representing several reputable English manufacturers, requires an

ELECTRICAL SALES ENGINEER

normally for employment in Bombay or Calcutta or Madras. Age preferred: 22 to 28. Applicant must hold degree in electrical engineering, or equivalent, from a U.K. university, and have had two years' practical experience with an approved U.K. manufacturer. Preference given to man having training and experience with switchgear manufacture and estimating. Three years agreement and six months' leave (with pay) from India if offered second agreement after termination. Initial kit allowance, £75. First-class passages. Monthly salary for single man 1,100 rupees first year, 1,200 rupees second year, 1,300 rupees third year, plus local monthly allowance 250 rupees. Additional allowance if married. Mutual contributory provident fund. Application must give full details of education, qualification, training and experience, and will be treated confidentially.

Apply Box No. 6029, Electrical Times.

(K 635p)

ELECTRICAL ENGINEER DRAUGHTSMAN required with experience in the design and installation of power and lighting schemes, distribution and control diagrams, etc. Excellent prospects for suitable men offered by Tees-side firm.—Apply, giving full particulars, quoting reference F.D., to Box No. 6027, Electrical Times. (K 658)

ELECTRICAL FOREMAN required by large oil company for Middle East duties. Candidates preferably not over 35 should have sound practical experience in operation and maintenance of h.t. and l.t. distribution systems and switchgear, and in installation and wiring of general industrial equipment. Salary incremental from £600 plus allowances £240 to £550 (dependent on marital circumstances) together with free furnished quarters and messing. Pensionable service. Paid biennial home leave. No married accommodation for first 2-3 years. Write, quoting No. 82, to Box 4174, c/o Charles Barker and Sons, Ltd., 31 Budge Row, London E.C.4. (K 650)

ELECTRICAL MAINTENANCE ENGINEER, married and between 30 and 35 years of age, required for factory operating continuous process. Starting salary £450 per annum, and free modern semi-detached house.—Please write, giving particulars of technical training and practical experience, to Box No. 6015, Electrical Times. (K 625)

ELECTRICAL switchgear manufacturers in Manchester district require a first-class SECTION LEADER for the development department in the drawing office. Only first-class men will be considered who have had experience on all classes of switchgear up to 11kV and motor control gear. Good salary for the right man.—Reply, stating age, experience, and technical qualifications, to Box No. 5089, Electrical Times. (K 525)

ENGINEERS required for all types of power cable installations, including underground, generating stations, etc. Opportunity to serve abroad.—Applicants should state experience and salary expected to Ref. 410, Siemens Brothers and Co., Ltd., Woolwich, S.E.18. (K 640)

EXPORT DEPARTMENT of City company require an ASSISTANT. Age 23-25, must have knowledge of electrical engineering. Good prospects for a keen and intelligent man.—Salary £350-£375 per annum.—Write: Box J870, c/o Streets, 110 Old Broad Street, E.C.2. (K 620)

FULLY experienced CHIEF DRAUGHTSMAN DESIGNER required by leading manufacturer of light domestic switches, etc., in West London. Capable of taking charge of all final drawing development work and of staff. Experience in design work of the highest technical standards essential. Salary required and full record of experience to Box No. 6031, Electrical Times. (K 679)

HANDLEY PAGE LTD. require an ELECTRICAL TECHNICIAN, preferably with H.N.C. (Elect.) and with a knowledge of electronics for work in connection with the development of aircraft electrical circuits and installations.—Write, stating age, qualifications and details of experience to: Staff Officer, Handley Page Ltd., Cricklewood, London N.W.2. (K 486)

JUNIOR DRAUGHTSMAN up to 25 years of age required for light electrical manufacturers in Croydon area with preferably some experience of design of sheet metal work.—Write, stating age and salary required, to Box P.419, Willings, 362 Gray's Inn Road, London W.C.1. (K 639)

MERZ AND MCLELLAN have a vacancy at their Esher office for an ENGINEER capable of preparing specifications, analysing tenders and dealing with engineering problems associated with rural and urban distribution up to 33 kV. Applicants should be qualified engineers who have preferably obtained an engineering degree, completed at least two years apprenticeship and preferably had two years experience of distribution work. Salary will depend on age and experience.—Applicants should reply to Merz and McLellan, Milburn, Esher, stating age, salary required, education, qualifications and details of training and experience. (K 661)

RECTIFIER ENGINEERS are required by the English Electric Co., Stafford. These vacancies are for qualified engineers for employment in the design, test or commercial departments, and applicants with experience of mercury rectifiers should write, giving full details, quoting ref. 425, to Central Personnel Services, English Electric Co., Ltd., 24-30 Gillingham Street, London S.W.1. (K 617)

REPRESENTATIVE. Old established manufacturers require well-connected Sales Representative, able to handle additional line of domestic and light industrial switchgear, covering Cheshire, Yorkshire, Lancashire, Northumberland and Durham area.—Full details in the first instance to Box No. 6019, Electrical Times. (K 654)

SENIOR AND JUNIOR DRAUGHTSMEN required for the electrical rotating machinery D/O of a large manufacturing concern in the Midlands. Men with sound mechanical D/O experience and training will be considered. The positions offer scope for advancement to keen men in a rapidly expanding department. Excellent working conditions; sports and social club, etc.—Please apply, giving full details of training, experience, age, etc., to Box No. 6025, Electrical Times. (K 657)

REPRESENTATIVE required by old established manufacturers of electrical wiring accessories to cover Midlands, East Midlands and Yorkshire. Salary, commission and expenses. Own car an advantage.—Apply with details of experience, area covered, present turnover and copies of references to Box No. 6023, Electrical Times. (K 656)

SHORTHAND TYPIST required by W.C. London architect's office for electrical consultant; age under 25.—Write: Box No. 6017, Electrical Times. (K 636)

TECHNICAL LABORATORY ASSISTANTS with some experience preferably in the electronic experimental field are required by the Research Laboratories of The General Electric Co. Ltd., East Lane, North Wembley, Middlesex. Good education essential; beyond Matriculation standard desirable.—Apply, in writing, to the Personnel Officer (ref. GBLC/90) quoting age and record. (K 633)

THE ELECTRICITY CORPORATION OF NIGERIA is about to appoint a CHIEF ENGINEER. The post will be pensionable and the successful candidate should be between the age of 35-45. Corporate membership of the Electrical and Mechanical Engineers is essential, preferably full membership. Alternatively, full membership of the Electrical, with a good degree. The responsibilities will ultimately be to direct and supervise the technical design, construction and operation of a system to comprise high pressure coal-fired steam-driven stations with long distance high tension network, with the possible addition of some hydro-electric capacity. The appointment will require the recognition and solution of economic and technical problems of an electricity undertaking in course of development under difficult circumstances. The salary will be £1,750 per annum basic, plus 10% temporary allowance on basic rate of pay, plus £500 expatriation allowance. Arrangements can be made for transfer of pension rights where these have accrued in present public employment.—Further particulars and forms of application can be obtained upon application to E. C. Inston, The Electricity Corporation of Nigeria, The Corner House, Great Peter Street, London S.W.1. (K 641)

THE HEAD WRIGHTSON MACHINE CO., LTD., require a fully qualified ELECTRICAL ENGINEER capable of preparing specifications and superintending the installation and starting-up of modern rolling mill and auxiliary machinery. Applications, stating age, experience and salary required, to be addressed to The Director and General Manager, The Head Wrightson Machine Co., Ltd., Commercial Street, Middlesbrough, marked "Private and Confidential." (K 651)

TRANSFORMER TECHNICAL ENGINEER required with particular experience in small h.v. transformers and testing equipment. Must be up to Higher National Certificate standard or equivalent.—Apply, giving details of previous experience, Personnel Officer, Foster Transformers & Switchgear Ltd., South Wimbledon. (K 631)

UGANDA—ASSISTANT ENGINEER with sound technical training to assist in investigation of electricity utilisation schemes and preparation of reports including make-up of plans and drawings. Single man, 30-35, preferred. Three year contract, salary approximately £800 per annum together with housing, outfit, free passage and leave on full salary.—Apply by letter, stating whether married or single and full particulars of qualifications and experience, to Box No. 6013, Electrical Times. (K 624)

WELL established electricity meter manufacturers require the services of GRADUATE ENGINEERS for their development laboratory. Applicants possessing Higher National Certificate in Electrical Engineering or approaching that standard will be considered.—Written applications, giving details of qualifications and experience to Box No. 6007, Electrical Times. (K 591)

WORK WANTED

A.C. and d.c. Motor Rewinds and Repairs. Prompt service, fully guaranteed.—Edgware 8631 (4 lines), Service Electric Co. Ltd., Stanmore, Middx. (D 324)

ARMATURE SERVICE CO. LTD., Haddington Street, Hove (Tel.: 32996), electrical engineers and winding specialists. Distance no object. (F 739)

S. C. H. Co.

4b STANLEY ROAD, SOUTHEND-ON-SEA

Having the organisation to produce Trade work from Blue prints to mass production competitively, are prepared to supply to Electricians for demonstration purposes

WARM o' COOL UNIT HEATERS

Particulars on request (H 540p)

CAPACITY available for light assembly of electrical mechanical equipment complete from drawings or prototype model, including tooling, moulds, machining and test if required.—Box No. 5077, Electrical Times. (K 485)

CASTINGS. Fisher Foundries Ltd., Greet, Birmingham, have capacity for brass, gun metal and soft grey iron machine moulded repetition castings weighing 1-30 lb. Loose pattern work up to 3 cwt. Delivery by road to all parts. Tel.: B.ham, Victoria 0197. (H 268)

WANTED

A.C./D.C. MOTORS, STARTERS, complete change-over installation, etc.—A.A. Electrical Co. Ltd., 67 Rothschild Road, Chiswick Park, W.4. Tel.: Chiswick 5105. (A 20)

ELECTRICAL STEEL OFF-CUTS OR COREPLATES required. Small and large quantities taken, approx. 0.024-in. gauge, minimum width 3 in.—Box No. 4077, Electrical Times. (K 219)

ENAMEL-COVERED copper wire, gauges 20-38 s.w.g.—Haddon Transformer Ltd., 27-35 Masons Avenue, Wealdstone, Middlesex (UND. 2070). (K 638)

HOOVER authorised dealers. Sell us your traded-in Hoover cleaners. Any condition, any quantity. Send for price list.—Modern Domestic Electrics Ltd., 29 Turnpike Lane, London N.8 (MOU. 8198). (K 637)

SCRAP ACCUMULATOR PLATES and Sediment wanted, any quantities. Also Storage Batteries purchased and dismantled.—Phone or write Elton Levy Co. Ltd., St. Ermin's (West Side), Caxton Street, London S.W.1. Tel.: WHItehall 9621/2/3. (A 3)

STEEL, ALUMINIUM, BRASS, Sheets, Strip, Bars, Off-cuts. Any quantity—immediate payment.—Grades Sheared Metal Co., Ltd., Green Lane, Hounslow, Middx. Tel.: Feltham 3274. (K 675)

WANTED, SCRAP ELECTRIC MOTORS, DYNAMOS AND CABLE. Top prices paid.—H. Reed, 36 Bridge Street, Leatherhead, Surrey. (K 11)

WANTED, ROTARY CONVERTERS, any size.—Universal, 221 City Road, London E.C.1. (A 16)

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 176 Brady Street, Bethnal Green, E.1. (A 1)

WANTED. Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock Water-tube Boilers. Best prices paid. Prepared to purchase Babcock and Wilcox Water-tube Boilers for dismantling. —Apply, giving full details to Midland Iron and Hardware Co., Cradley Heath. (A 5)

WANTED. D.C. and A.C. ball-bearing MOTORS, MOTOR GENERATOR SETS, DYNAMOS and ALTERNATORS.—Full details to Britannia Manufacturing Co. Ltd., 22-26 Britannia Walk, London N.1. (A 13)

WANTED. Surplus stocks of Hand, Precision and Cutting Tools, Twist Drills, Taps and Dies, Files, Reamers, Cutters, etc.—Send details to B. Draper and Son, 1 Grange Road, Kingston-on-Thames. We pay cash upon delivery. (K 659)

1,200 H.P. Squirrel-cage or slip-ring induction MOTOR revolving at 250 r.p.m. Synchronous speed preferred, but other speeds up to 750 r.p.m. would be considered.—Offers, with full details, to: Oldfield Engineering Co. Ltd., 96 East Ordsall Lane, Salford 5. (K 533)

AGENCIES

AGENT-STOCKIST required for Bristol area, by well-known cable manufacturer (C.M.A.).—Reply, giving full details, to Box No. 5099, Electrical Times. (K 577)

MANUFACTURERS' AGENTS ASSOCIATION, INC. (E.T.), 8 Bream's Buildings, London W.C.2, supplies free lists of Agents to Manufacturers seeking representation in important industrial centres. Membership available to established agents only. Particulars supplied. (A 7)

FOR SALE

CABLES & WIRE

ALL types T.R.S. and V.I.R. CABLE in stock. Buy now while obtainable. Send for price lists.—Northern Industries, Snow Hill, Manchester 4. (D 50)

LIGHTING EQUIPMENT

TRANSTAR CONTROL GEAR. "Winco" FLUORESCENT FITTINGS, "Winco" DISTRIBUTION BOARDS. Special prices on application. Metal-clad, 2-way SPLITTERS, 7s. 6d. each. Arrow 60-amp. D.P. SWITCHES, 10s. each. 14 gauge GALV. CHAIN, 6s. doz. yards. BATTEN HOLDERS, 12s. doz. L.B.C.C.G. HOLDERS, 9s. doz. 15-amp. shutter-type PLUGS and SOCKETS, 6s. each. Factors of Cable, Flexes, Switchgear, Cable Clips, etc. Carriage and packing paid on orders of £10 or over.

WINCO INDUSTRIES

17 Stretford Road, Manchester 15. (Tel.: Mos. 1364.)

PURLEY CHOKES AND BALLASTS. Our 80-w. Tapped h.p.f. Ballast, with Starter Switch-holder incorporated, is proving itself the most popular unit. Suitable for most fittings, 57/6 each, subject.—F. W. Blanchard Ltd. (Dept. ET), Purley, Surrey. Uplands 4818/9. (E 343)

QUANTITY of miscellaneous Electrical Accessories comprising Conduit Fittings, Switches, Switch Fuses, Insulating Materials, Lamps, Reflectors, etc., including new and second-hand for disposal. Can be viewed on application to the Stores Controller, Messrs. Courtaulds Ltd., Foleshill Road, Coventry. (K 632)

DOMESTIC APPLIANCES

IMMERSION HEATERS. Grubb 4 kW. No purchase tax. All lengths, 16 in. to 36 in. Standard voltages. Provision for intermediate loadings. Fully guaranteed. Write for illustrated brochure, latest lists and trade terms to distributors.—John Owner and Co. Ltd., Springfield Road, Birmingham 13. Tel.: Spr. 2939. (C 392)

GENERATING PLANT

DISTRICT MENTAL HOSPITAL, CASTLEBAR

ELECTRIC LIGHTING PLANT FOR SALE

TENDERS are invited for the purchase of the undermentioned electrical engines (makers: Messrs. W. and H. Allen, Bedford, England), generators, etc.

Two 50-h.p. Vertical Crude Oil Engines, 275 r.p.m. Direct coupling to generators. Two Generators, d.c., 210 V, 125/119 amps, 275 r.p.m., 25 kW.

Four Air Bottles with pressure gauges 150 lb. Two Fuel Tanks. Two d.c. Motor Circulation Pumps, 210 V, 1,250 r.p.m., 2·6 amps, ½ b.h.p. One Booster set, motor 7 b.h.p., 210V, 29·2 amps, 1,250 r.p.m., One Booster 10/110 V, 40 amps, 1,250 r.p.m., 44 kW.

One Compressor for filling air bottles, 2 b.h.p. motor, 210 V, shunt winding, 9½ amps, 750 r.p.m.

Switchboard. Five panels with volts and ampere gauges, circuit breakers. Four lighting circuits, two power circuits, one lighting meter, one power meter.

Tenders should be addressed to the Chief Clerk, Mental Hospital, Castlebar, and should reach him not later than 1 p.m. on Saturday, May 26, 1951. (K 642)

METERS

A.C/D.C. QUARTERLY AND SLOT-METERS. Guaranteed, sent on approval if desired.—Brent Electrical Co., 6 Holmdale Gardens, London N.W.4. (A 15)

HOUSE-SERVICE METERS, a.c. or d.c., quarterly or prepayment.—Universal Electrical, 221 City Road, London E.C.1. (C 51)

METERS, a.c. and d.c., new and reconditioned, all types. Quarterly, single and three phase, 3 and 4 wire, 2½ to 1,000 amps. Prepayment, single and double tariff, single, dual and triple coin, fixed and variable tariff, 2½ to 50 amps. M.D.I., Billiards Switches, Rent Collectors. Prices from 5/- carriage paid, guaranteed for ever, immediate delivery.—Illustrated catalogue from The Electric Meter Company, Castor Road, Brixham. (K 678)

MOTORS & STARTERS

ELECTRIC MOTORS, GENERATORS, TRANSFORMERS A.C. & D.C.

STARTERS, SLIP RING & D.C., SEMI-AUTOMATIC

Any voltage, new, short delivery, all types of revolving electrical power.

ELECTROPOWER COMPANY LIMITED

Kingsbury Works, Kingsbury Road, London N.W.9. Telephone: COLindale 4621/2. (D 17p)

A. A. ELECTRICAL CO.—FOR A.C./D.C. MOTORS, SWITCHGEAR, EXHAUST FANS, HOISTS, REDUCTION GEARS, new or reconditioned units.—Chiswick 5105, Fairlands 8279, 67 Rothschild Road, W.4. (A 19)

A. C. and D.C. MOTORS all sizes, large stocks fully guaranteed.—Milo Engineering Works Ltd., Milo Road, East Dulwich, S.E.22. (Forest Hill 2278-9). (A 10)

A. C. and D.C. MOTORS, GENERATORS, from stock.—Service Electric Co., Ltd., Honeypot Lane, Stanmore, Middx. Edgware 8631/4. (A 476)

A. C. and D.C. MOTORS, GENERATORS, SWITCHGEAR, etc., always in stock. Let me have your inquiries.—G. E. Whittaker, Wellington Mill, Bolton Road, Blackburn. Tel.: 7232. (A 12)

ELECTRIC MOTORS FOR 400/3/50.

225-h.p. internal S/R motor by A.S.E.A., type M.22, open protected frame, two end-shield oil bearings. Mounted on C.I. bedplate, shaft fitted pulley 26 in. diam. by 28 in. face, for flat belt drive. Rotor volts 482, rotor amps 208. Speed 485 r.p.m. Complete with control gear.

170-h.p. compensated induction motor by E.E.C. (suitable for power factor correction), size AGS.C16, protected type frame with end-shield B/R bearings. Standard shaft extension fitted vee rope pulley. Commutator machine with ext. sliprings. Speed 720 r.p.m. With control gear.

150-h.p. synchronous induction, Mather and Platt, 505 amps, 0·39 p.f., speed 750 r.p.m., rotor volts 1,370, rotor amps 50. Open protected type. Complete with exciter and control gear.

135-h.p. S.C. induction, E.E.C., speed 589 r.p.m. Totally encl., pipe cooled. Cont. rated, 175 amps.

110-h.p. auto synchronous motor by Crompton, screen protected type, end-shield B/R bearings. Unity power factor, flange mounted exciter, bare shaft extension, speed 500 r.p.m.

100-h.p. S/R., G.E.C., speed 725 r.p.m. Encl. ventilated.

85-h.p. S/R Holmes, speed 485 r.p.m. Protected type. Rotor volts 250, rotor amps 180.

Two 75-h.p. S/R motors by L.D.C., screen protected type with end-shield ball bearings. External T.E. cont. rated sliprings. Rotor volts 245/268, rotor amps 142/129, speed 485 r.p.m.

George Cohen Sons and Co. Ltd., Wood Lane, London W.12. (Tel.: Shepherds Bush 2070) and Stanningley, near Leeds (Tel.: Pudsey 2241). (K 621)

FOR ELECTRIC MOTORS, GENERATORS, ALTERNATORS, SWITCHGEAR, please send your inquiries to Oldfield Engineering Co., Ltd., 96 East Ordsall Lane, Salford 5. (C 296)

THE Kettering Corporation have for sale one vertical type secondhand Bull 15 h.p., 415 V, 3-phase, 50 c/s, slip-ring MOTOR, 710 r.p.m., complete with starter.—Offers should be addressed to the Borough Engineer, 3 Gold Street, Kettering. (K 573)

SWITCHGEAR

MERCURY SWITCHES are made by Hall Drysdale and Co. Ltd., of 58 Commerce Road, Wood Green, London N.22. Tel.: Bow 7221. (C 175)

ONE double-pole, oil-immersed CIRCUIT-BREAKER 200-amp. 660 V—wall fixing type with o/l and n/v release; (George Ellison) second-hand.

Two ditto, 25-amp. 600 V.

One TRANSFORMER, auto wound, 5 kVA; (Zenith) wall fixing type, 110/220 V, single-phase, 50 c/s; second-hand.—W. Mackie and Co. Ltd., 129-133 Lambeth Road, London S.E.1. (K 616)

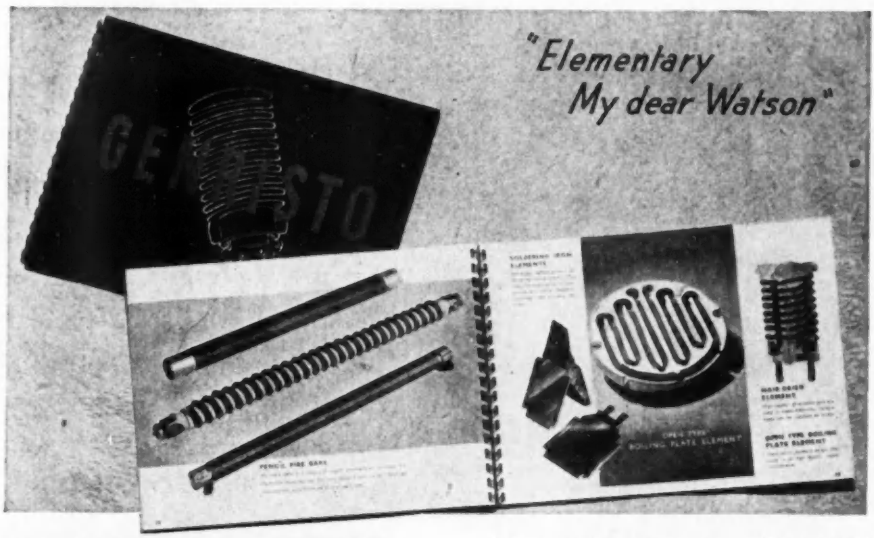
TRANSFORMERS & CONVERTORS

VEHICLE Battery Charging RECTIFIERS by Westalite. Designed input 400/440 V, 3-phase, 50 cycles. Output 45 amps. 140 cells. Type 8V/40/45. Completely ready for use.—Oldfield Engineering Co. Ltd., 96 East Ordsall Lane, Salford 5. (K 634)

MISCELLANEOUS

CITY AND GUILDS (Electrical, etc.) on "No pass—No Fee" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 176-page handbook, FREE and post free. B.I.E.T. (Dept. 39), 17 Stratford Place, London W.1. (D 244)

RICHARDS AND PARTNERS, associated with George Offord and Co., Auctioneers and Valuers of PLANT AND MACHINERY AND INDUSTRIAL PROPERTY, Granville House, Arundel Street, London W.C.2. Tel.: TEMple Bar 7471. (A 23)



GENRISTO LTD

If you want the best Elements, specify "Genristo." And a most useful first step is to send for the "Genristo" Catalogue, a handsome and useful booklet. Enquiries on business letter headings only.

OSMASTON STREET, NOTTINGHAM

INDEX TO ADVERTISERS

Alton Battery Co., Ltd. ... 30
Arrow Electric Switches, Ltd. ... 42
Association of Steel Conduit Manufacturers 67
Attwater & Sons, Ltd. 76
Automatic Coil Winder & Electrical Equipment Co., Ltd. ... 63
Automatic Light Controlling Co., Ltd. 76

Belmos Co., Ltd. 12
Benjamin Electric, Ltd. 47
B. & H. (Nottingham), Ltd. ... 74
Birmingham Aluminium Casting (1903) Co., Ltd. 29
Bray, George & Co., Ltd., ... 74
British Insulated Callender's Cables, Ltd. 17, 32
British Insulated Callender's Construction Co., Ltd. ... 27
British National Electrics, Ltd. 71
British Thomson-Houston Co., Ltd. 45, 82
Britmac Electrical Co., Ltd. ... 24
Brook Motors, Ltd. 18
Burco, Ltd. 78

Cable Makers Association ... 21
Clang, Ltd. 76
Clifford, Charles, & Son, Ltd. ... 72
Cox-Walkers, Ltd. 66
Crabtree, J. A., & Co., Ltd. ... 19
Crane, Walter ... ... - ... 74
Cressall Manufacturing Co., Ltd. 4
Crompton Parkinson, Ltd. 41, 65
Cyc-Arc, Ltd. 4

Daleman, Richard, Ltd. 14
Dewrance & Co., Ltd. 80

East London Mica Works ... 64
Edwards, F. J., Ltd. 78
Electrical Remote Control Co., Ltd. 78
Electrical Times 66
English Clock Systems, Ltd. ... 14
English Electric Co., Ltd. 1, 35
Essex Partners, Ltd. 76
Evans & Newall, Ltd. 68
Evershed & Vignoles, Ltd. ... 44

Ferguson Pailin, Ltd. 33
Ferranti, Ltd. 43

General Electric Co., Ltd. 50, 77
Genristo, Ltd. 61
Gent & Co., Ltd. 31
Grimmer, W. H. 78

Harboro' Rubber Co., Ltd. ... 34
Hart Accumulator Co., Ltd. ... 22
Heatrae, Ltd. 25
Henley's, W. T. Telegraph Works Co., Ltd. 51
Higgs Motors, Ltd. 10

International Combustion, Ltd. 11
Isenthal & Co., Ltd. 28

Johnson & Phillips, Ltd.... ... 39

London Electric Wire Co., and Smiths, Ltd. 26
Low, Duncan, Ltd. 14

McGeoch, William, & Co., Ltd. 64
Measurement, Ltd. 37
Metropolitan-Vickers Electrical Co., Ltd. 9, 73
Metway Electrical Industries, Ltd. 62
Micramatic. Ltd. 34
Mudie's Electrical Co., Ltd. ... 28

Nalder Brothers & Thompson, Ltd. 79
National Cash Register Co., Ltd. 78
New Day Electrical Accessories, Ltd. 22
Newton Brothers (Derby), Ltd. 70
Nu-Swift, Ltd. 74

Parmiter, Hope & Sugden, Ltd. 81
Partridge, Jones & John Paton, Ltd. 20
Premier Electric Heaters, Ltd. ... 7

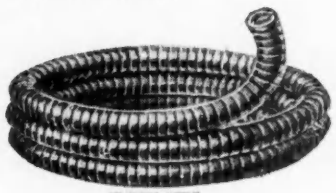
Reyrolle, A. & Co.,, Ltd. ... 5
Rowlands Electrical Accessories, Ltd. 69
Rozalex, Ltd. 64

Sanders, William & Co. (Wednesbury), Ltd. 34
Sangamo Weston, Ltd. 52
Santon, Ltd. 16
Saxonia Electrical Wire Co., Ltd. 66
Scottish Cables, Ltd. 6
Siemens Brothers & Co., Ltd. ... 13
Simmonds & Stokes, Ltd. ... 66
Simplex Electric Co., Ltd. ... 2
Sloan Electrical Co., Ltd. ... 68
Smart & Brown (Engineers), Ltd. 40
Smith Meters, Ltd. 48
South Wales Switchgear, Ltd. ... 75
Stewarts & Lloyds, Ltd. 3

Tant, W. H., & Co., Ltd. ... 46
Thorpe, F. W., Ltd. 70
T. M. C. Harwell (Sales), Ltd. ... 15

Wakefield, C. C., & Co., Ltd. ... 38
Wandleside Cable Works, Ltd. 68
Warsop Power Tools, Ltd. ... 8
Westinghouse Brake & Signal Co., Ltd. 23
Whiteley, B. S. & W., Ltd. ... 36
Wilden, George 4
Wootton & Co., Ltd. 72

METWAY PRODUCTS
Registered Trade Mark



Galvanised Steel
FLEXIBLE
METALLIC
TUBING
for many purposes

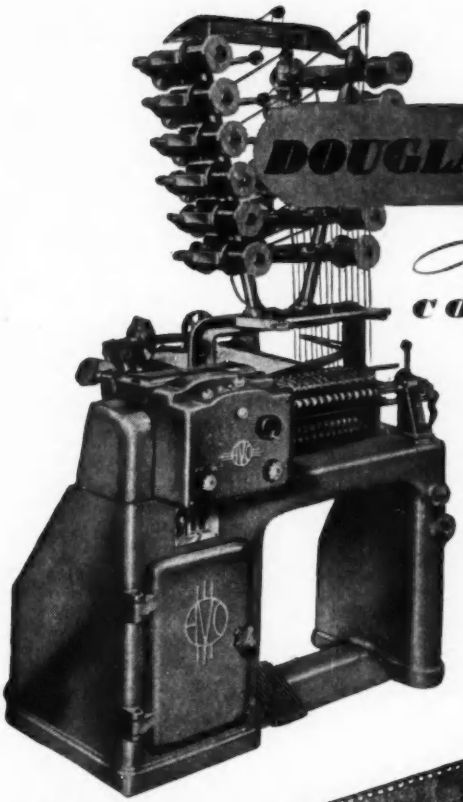
NON-WATERTIGHT
Unpacked . . . $\frac{3}{16}$"—3" bore

WATERTIGHT
Asbestos packed $\frac{3}{16}$"—3" bore

WATERTIGHT
Rubber packed . $\frac{1}{2}$"—3" bore

Send 6d. stamps to cover postage for
92-PAGE LIST No. OH/31/T.E.

METWAY ELECTRICAL INDUSTRIES LTD.
KING STREET, BRIGHTON 1
Phone: Brighton 28366. Grams: Metway, Phone, Brighton



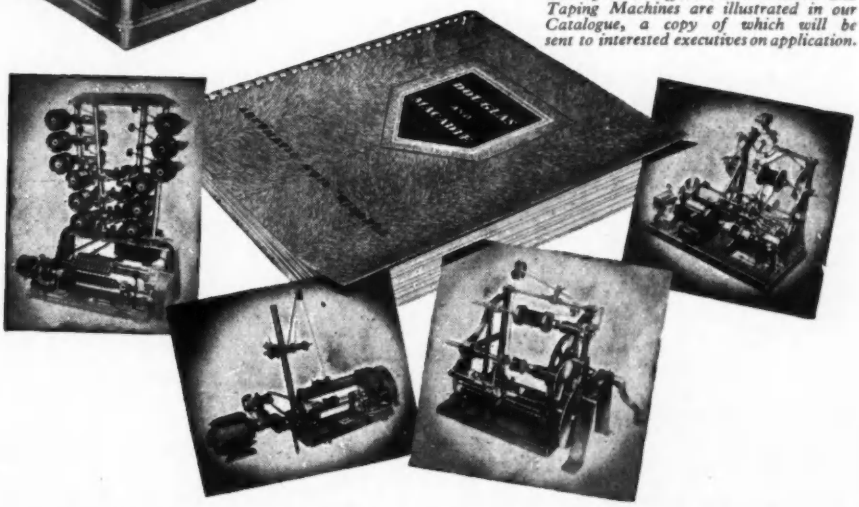
DOUGLAS AND MACADIE

Automatic

COIL WINDERS

The large illustration depicts the improved "Douglas" Fully Automatic Multi-Winder, specially developed for the high-speed production of large quantities of coils with or without paper interleaving. It will produce round, square or rectangular coils up to 6 in. each in length and up to 4½ in. diameter. As many as 12 smaller coils can be wound simultaneously within the total available winding length of 15 in. at headstock speeds of between 600 and 2,000 r.p.m.

Twenty-seven different Coil Winders and Taping Machines are illustrated in our Catalogue, a copy of which will be sent to interested executives on application.



THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD.
Winder House, Douglas Street, London, S.W.1 *Telephone: VICtoria 3404-9*

C2

Electrical Insulation

MICA
Washers
Plates
Commutator Segments
Stampings
Stove Plates
Heater Strips, etc.

MICANITE
Mouldings, Commutator Vee Rings, Tubes, Covered Bars, Commutator Segments, Heater Strips, Sheet Material in Moulding, Flexible, Heat Resisting and Commutator Qualities, etc.

BAKELITE
Tubes
Bushes
Bobbins
Washers
Stampings
Panels
Covered Bars, etc.

Manufactured by

EAST LONDON MICA WORKS

RINGWOOD ROAD, WALTHAMSTOW, LONDON, E.17

'Phone: KEYstone 4254 *Telegrams: Elmicmer, Easphone, London*

Used
BEFORE WORK
keeps
HANDS HEALTHY
and
CLEAN

ROZALEX

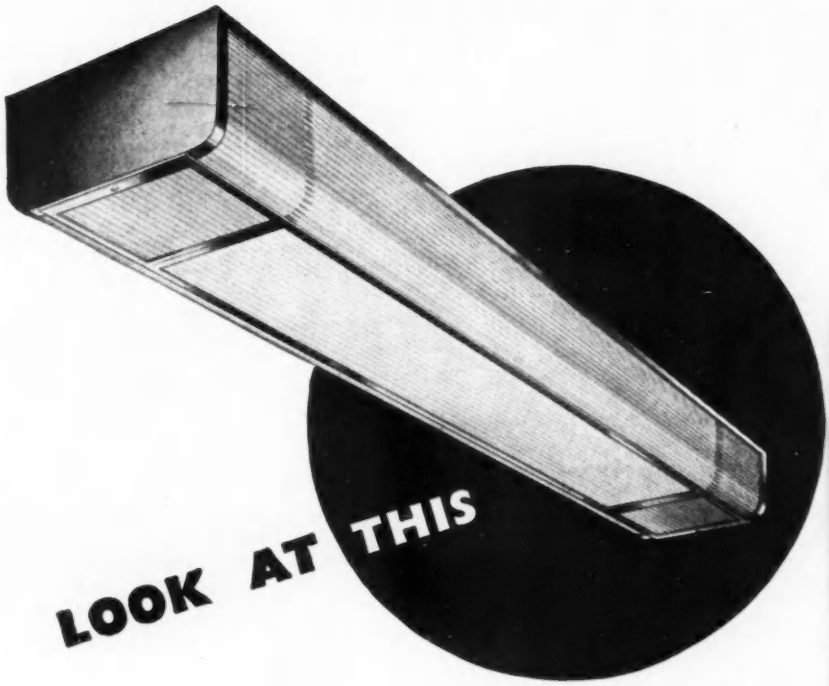
The invisible glove

No doubt you saw our new range of

WATERTIGHT LIGHTING FITTINGS
at the B.I.F.

May we mail you our latest list?

William McGEOCH & Co. Ltd.
Warwick Works, BIRMINGHAM 10
also at GLASGOW, LONDON
and NEWCASTLE-ON-TYNE



LOOK AT THIS

for better lighting style

One of a family of designs for lighting, this Crompton fitting (No. AE.2431) has dignity of line coupled with simplicity of construction, to satisfy your future needs.

Consider these features:—

ENCLOSED BASE for soft diffused light without glare.

INSTALLATION on ceiling surface or pendant with suitably styled downrod set and easy fixing devices.

MAINTENANCE simple in the extreme with only one finger-operated catch giving access to lamps and starters.

SMOOTH DESIGN offers no place for dust or dirt to collect.

METALWORK pre-treated to resist corrosion and finely lacquered.

SIDE AND BASE PANELS of crystalline fluted finish or of plastic light opal material.

COLOUR neutral aluminium specially selected to harmonise with modern decoration.

LAMPS 2 x 80w. Crompton fluorescent tubular lamps.

There is a Crompton lighting fitting and lamp for most places and a Crompton lighting engineer to serve you in every place.

E

Built to better purpose by

Crompton

BY APPOINTMENT MANUFACTURERS OF ELECTRIC LAMPS TO H.M. THE KING

CROMPTON PARKINSON LTD.
CROMPTON HOUSE
ALDWYCH . LONDON . W.C.2

Telephone: CHAncery 3333
Telegrams: Crompark, Estrand, London

NIPHAN

WEATHERPROOF METAL-CLAD PLUGS, SOCKETS, SWITCH PLUGS, ETC. for all electrical purposes

5/300 amp. 250/500 volt.

Plug
Through Angle Socket with Cover and Plug
C.I. Terminal Socket & Cover with through sealing chamber and glands for cable
Plug
C.I. Switch Socket and Plug
Flange Socket and Cover

(Latest Catalogue on Application)

SIMMONDS & STOKES LIMITED

MANUFACTURING ELECTRICAL ENGINEERS

Victoria House, Southampton Row, London, W.C.1 · Holborn 8637 and 2163

OVERSEAS AGENTS: S. AFRICA, Hubert Davies & Co., Ltd., Johannesburg. NEW ZEALAND, Samuel Brown, Ltd., Wellington. INDIA, G.E.C. (India) Ltd., Calcutta. CEYLON, Walker & Greig, Ltd., Colombo.

MORE— —THAN

FIFTY YEARS

SPECIALISATION IN —

INSULATED ELECTRIC WIRES, CABLES & FLEXIBLE CORDS

The SAXONIA ELECTRICAL WIRE Co. Ltd

ROAN WORKS GREENWICH S.E.10

Phone Greenwich 0463 : 1672 ◆ Grams: Saxonist, London

Instruction Chart

For dealing with apparent death from

ELECTRIC SHOCK

(*In accordance with H.O. Electy. Reg.* 29)

Mounted on strong board, varnished and corded for hanging.

Price 3/- plus 10d. postage (per single copy)

ELECTRICAL TIMES

Sardinia House

SARDINIA STREET · LONDON · W.C.2

COXPARO Up to 2 amps

COXOHM 2 amps-6 amps

COXPAR over 6 amps

A Range of AUTOMATIC VOLTAGE REGULATORS TO SUIT ANY ALTERNATOR OR GENERATOR

HIGH accuracy -LOW cost!

Est. 1880.

COX-WALKERS, LTD

PHONE 2387 "GRAMS COXPAR"

NORTH EASTERN ELECTRIC WORKS, DARLINGTON

THIS MARK

TO BE SURE

A.S.C.M. MEMBERS ARE AS FOLLOWS:

- Alma & Cranmore Tube Co. Ltd.
- Barlow, H. J. & Co. Ltd.
- Electrical Conduits Ltd.
- General Electric Co. Ltd.
- Griffiths, Isaac & Sons
- Hildick & Hildick
- McDougall, James, Ltd.
- Metallic Seamless Tube Co. Ltd.
- Monmore Conduits Ltd.
- Simplex Electric Co. Ltd
  - Comprising:
  - Credenda Conduits Co. Ltd.
  - Perfecta Tube Co. Ltd.
  - Simplex Conduits Ltd.
  - Stella Conduit Co. Ltd.
- Steel Tube & Conduit Co. (Middlesbrough) Ltd.
- Talbot-Stead Tube Co. Ltd.
- Tipper Bros. (Bilston) Ltd.
- Walsall Conduits Ltd.

Advert of the
ASSOCIATION of STEEL CONDUIT MANUFACTURERS
21 Waterloo Street
Birmingham, 2

NEWALL Adjustable GIRDER CLIPS (SHERARDISED FINISH)

To all types and sizes of Girders

Standard Size for ⅜ in., ½ in. or 1 in. diameter Tubes or Armoured cables of equal diameter. **Tubes or Cables** can be run at *right angles or parallel to* Girders, by releasing countersunk locking screw, and turning Saddle Plate one-quarter turn.

Larger Sizes for 1¼ in., 1½ in. and 2 in. diameter Tubes or Armoured cables. Multiples to order.

EVANS & NEWALL LTD. (T.I.M.)
in association with **E. M. EVANS & SON LTD.**
Cornwall Street, New Cross, Manchester 4
Telephone: CENtral 1253-4 *Telegrams:* "Cymric"

Illustrated Catalogue and full particulars will be forwarded on request

---

Compensation for a HARD WINTER be prepared for a HOT SUMMER

Select your Fans early, while adequate stocks are available, from the range shown in our new booklet, a copy of which will be gladly sent on request.

Sloan Electrical Co. Ltd.

Slonetric House, Bondway, London, S.W.8

Bristol · Ealing · Kingsway, W.C.2 · Peckham · Truro

E.W.F. ELECTRICAL WHOLESALERS FEDERATION MEMBER

Edinburgh · Exeter · Leyton · Manchester · Watford

NOT JUST— **CABLE**

V.I.R. Taped and Braided; Tough Rubber; Lead Covered and Flexibles

BUT—

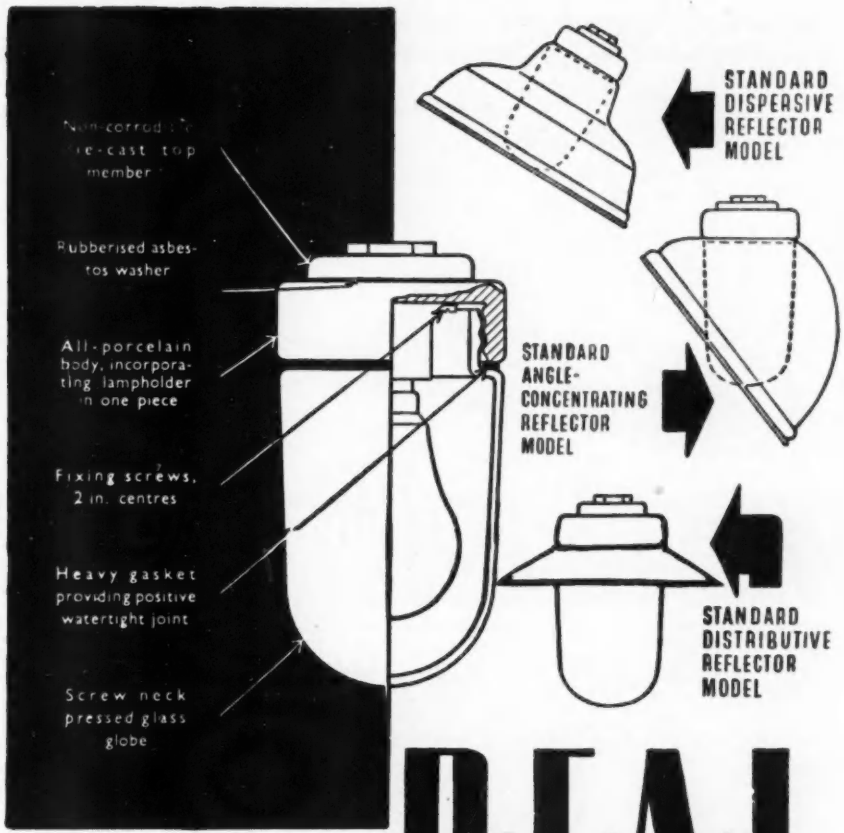
CABLE OF QUALITY

WANDLESIDE CABLE WORKS LTD.
106, Garratt Lane . Wandsworth . London, S.W.18

Telephone: Battersea 2273/4

Telegrams: Wandleside. London.

WANDLE BRITISH MADE CABLE


Non-corrodible die-cast top member
Rubberised asbestos washer
All-porcelain body, incorporating lampholder in one piece
Fixing screws, 2 in. centres
Heavy gasket providing positive watertight joint
Screw neck pressed glass globe
STANDARD DISPERSIVE REFLECTOR MODEL
STANDARD ANGLE-CONCENTRATING REFLECTOR MODEL
STANDARD DISTRIBUTIVE REFLECTOR MODEL

R·E·A·L

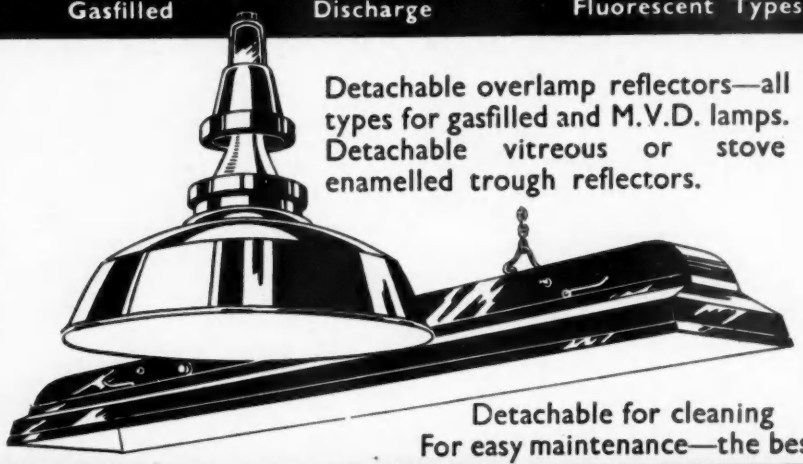
Non Corrodible Watertight Fittings

Send for Leaflet of Complete Range

60 WATT FITTINGS
100 WATT FITTINGS
200 WATT FITTINGS

Issued by ROWLANDS ELECTRICAL ACCESSORIES LTD., R·E·A·L WORKS, BIRMINGHAM, 18

THORLUX INDUSTRIAL LIGHTING EQUIPMENT. Manufacturers of Gasfilled Discharge Fluorescent Types



Detachable overlamp reflectors—all types for gasfilled and M.V.D. lamps. Detachable vitreous or stove enamelled trough reflectors.

Detachable for cleaning
For easy maintenance—the best.

F. W. THORPE LTD. WELBY RD HALL GREEN **BIRMINGHAM 28**

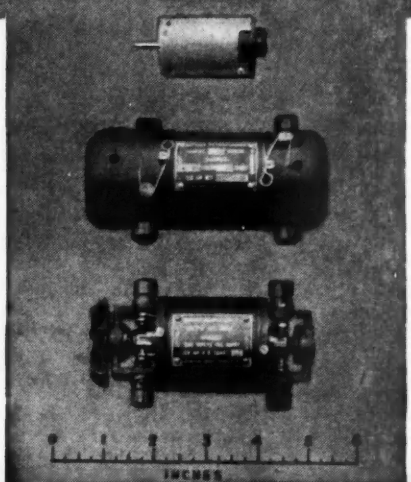
SPRINGFIELD 3318 GRAMS: THORLUX B'HAM

NEWTON-DERBY

LIGHTWEIGHT ELECTRICAL EQUIPMENT

Our manufactures include:
Aircraft Generators and Motors
Automatic Voltage Regulators
Rotary Transformers
High Frequency Alternators
H.T.D.C. Generators

The illustration shows a small high-speed fractional H.P. motor and miniature Rotary Transformers for "Walkie Talkie" and other RADIO applications.



NEWTON BROTHERS (DERBY) LTD.

HEAD OFFICE & WORKS: ALFRETON ROAD, DERBY. TELEPHONE: 4286/7. TELEGRAMS: DYNAMO, DERBY
LONDON OFFICE: IMPERIAL BUILDINGS, 56 KINGSWAY, W.C.2

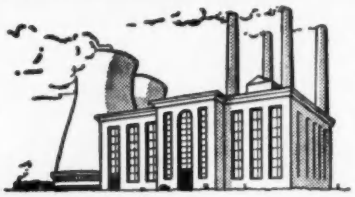
We're telling everybody!

In particular . . . we're telling the women of Britain, through their own magazines and periodicals, all about the B.N.E. C.49 Cooker . . . and they are sitting up and taking note! The advertisements, reproduced here, are bringing in the enquiries. Demand is being created, and you can take advantage of this powerful national advertising by displaying B.N.E. C.49 Cooker prominently in your window or showroom. Selling aids are available—write for details.

BRITISH NATIONAL ELECTRICS LTD.

THE DOMESTIC APPLIANCES SECTION OF JOHNSON & PHILLIPS LTD.

NEWARTHILL MOTHERWELL SCOTLAND



PHOSPHOR BRONZE

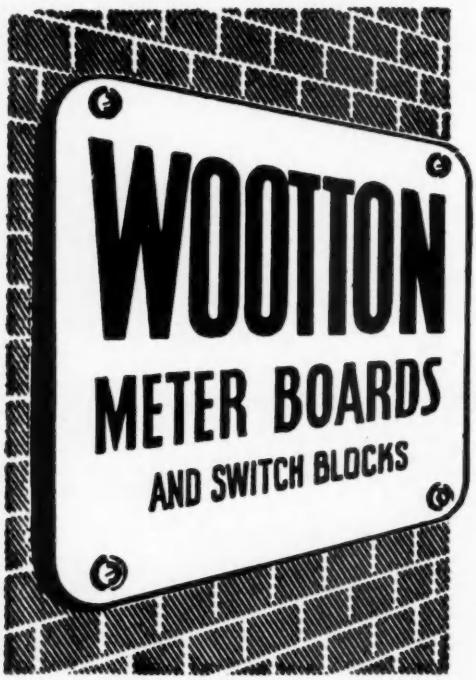
for the Electrical Industry

SHEET, STRIP, ROD, WIRE, TUBE, CHILL CAST BARS

In a range of alloys containing 3% – 12% Tin, for specific purposes; to **private** specifications and to British Standard Specifications.

CHARLES CLIFFORD & SON LTD., DOG POOL MILLS, BIRMINGHAM 30
AND FAZELEY ST. MILLS, BIRMINGHAM 5. OFFICES: LONDON, GLASGOW, MANCHESTER & DUBLIN

M-W.62



We have been making and supplying the Electrical Industry with METER BOARDS and Switch Blocks for over 27 years

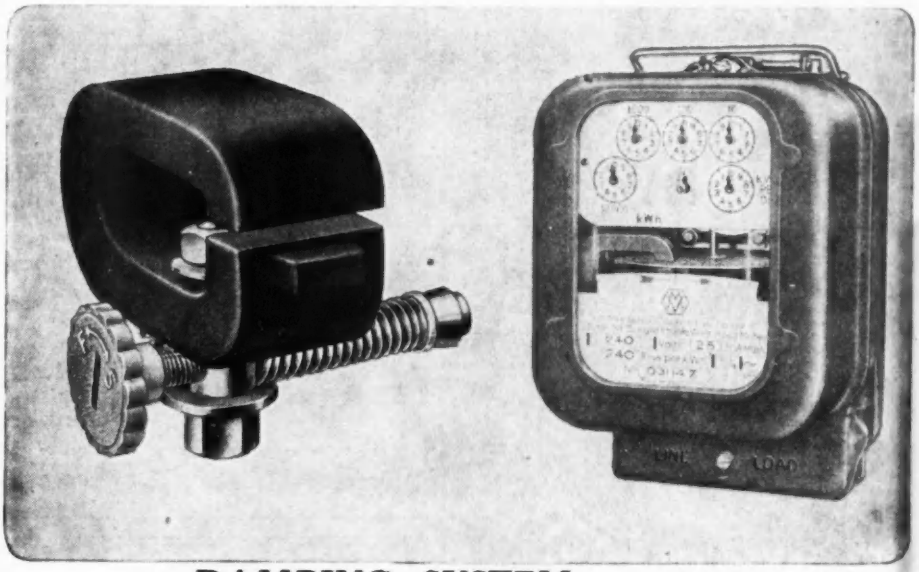
- *FIRST CLASS WORK*
- *QUICK DELIVERIES*
- *COMPETITIVE PRICES*

We invite your enquiries

WOOTTON & CO., LTD.
ALMA WORKS, PONDERS END, MIDDX.
TELEPHONE: HOWARD 1888
L1048A

Meticulous Metering

by the METROVICK TYPE NF Watt-hour Meter.



5—DAMPING SYSTEM

Always an outstanding feature of Metrovick meters the brake-magnet assembly of the NF Meter has:—
(i) high coercive force coupled with magnetic stability (ii) immunity to stray fields, (iii) easy and accurate adjustment, (iv) simple to mount and remove and (v) light in weight.
Made in "Alnico", chosen as the most suitable material for the purpose, the permanent magnet of the NF Meter is designed to reduce waste leakage flux to a minimum.
The illustration above shows the magnet with its adjusting screw.

Other advertisements in this series:—
2—CASES and COVERS. 3—PERFORMANCE: 4—REGISTERING MECHANISM: 6—RESILIENT BEARING: 7—TEMPERATURE COMPENSATION: 8—ACCESSIBILITY and TERMINALS: 9—CALIBRATION ADJUSTMENTS.

WRITE FOR A COPY OF PUBLICATION S.P. 7356/2

METROPOLITAN-VICKERS ELECTRICAL CO. LTD.

TRAFFORD PARK, MANCHESTER 17
Member of the A.E.I. group of companies

G/A005

CERAMIC EMBEDDED AND METAL CLAD . . .

Industrial and Domestic Electric Heaters

FOR *Reliability*

BRAY

GEO. BRAY & Co LTD.
LEICESTER PLACE, LEEDS 2
PHONE 20981 (8 LINES) GRAMS BRAY LEEDS

QUALITY PRODUCTS

Send for Folder Covering Range

Made in Britain
SOLD THE WORLD OVER

B. & H. (NOTTM.) **LTD.**
POPHAM STREET, NOTTINGHAM
Telephone 43826 *Telegrams* "VOLTS" *Nottm.*
London Office: 47-49 CALEDONIAN RD., LONDON, N.1

ELECTRIC MOTORS

Fractional—50 H.P.
Repaired and Rewound

WALTER CRANE
GREENCOAT WORKS, WAKEFIELD

FIRE!
WHERE'S YOUR
NU-SWIFT?

The World's Fastest Fire Extinguishers
— for every Fire Risk
Pressure-operated by sealed CO_2 Charges
NU-SWIFT LTD • ELLAND • YORKS
In Every Ship of the Royal Navy

QUICK DELIVERY

Illustration shows a block of Ring Main units under construction—part of a large order for 150 MVa and 250 MVa gear.

Thanks to their policy of forward manufacture of all standard parts, South Wales Switchgear can build—and deliver—their switchgear units in quantity in the minimum of time. Write for details of the range available.

SOUTH WALES SWITCHGEAR LIMITED
BLACKWOOD · MON.

ESTABLISHED 1840

ATTWATER & SONS

HOPWOOD STREET MILLS.
PRESTON.

MICA & MICANITE

IN ALL FORMS & QUALITIES.

BAKELITE SHEETS · TUBES · BOBBINS · VARNISH AND ROSIN
FOR OIL SWITCH GEAR & TRANSFORMERS

VULCANISED FIBRE SHEETS. TUBES AND RODS.

PEERLESS **LEATHEROID** INSULATION.

BAKELAQUE INSULATION
BEST BRITISH MANUFACTURE

Cotton and also Asbestos Dynamo Tapes.

Presspahn and Fullerboard In Sheets and Rolls.

Empire Cloth and Tapes

Ebonite and all Insulating Material for Electrical Engineers.

ESSEX

Patent

FLANGES

for Fixing

IMMERSION HEATERS

THERMOSTATS, ETC.

TO CLOSED TANKS AND CYLINDERS
REMOVAL OF MANLIDS UNNECESSARY
NO SOLDERING
PURE MECHANICAL FITTING INTO ONE ROUND HOLE

ESSEX PARTNERS LIMITED
Manufacturing Engineers
56-62 SOUTH CASTLE ST., LIVERPOOL 1
Tel: Central 0895 Grams: "Epabos" Liverpool

USE **"GUNFIRE"**
TRADE MARK

Time Switches
AND
Process Timers
FOR SATISFACTION

AUTOMATIC LIGHT CONTROLLING CO. LTD.,
BOURNEMOUTH
Established over Fifty Years.

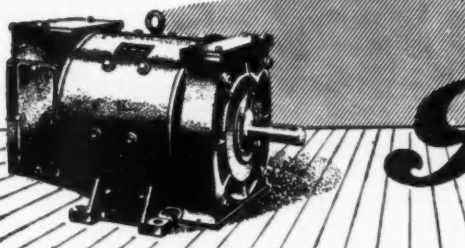
"A GOOD TIP!"
ELECTRICAL ACCESSORIES
BY

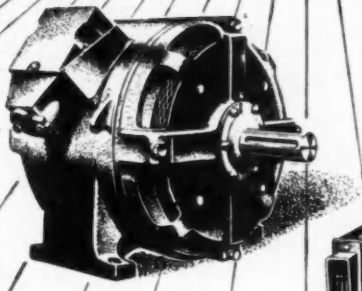
CLANG

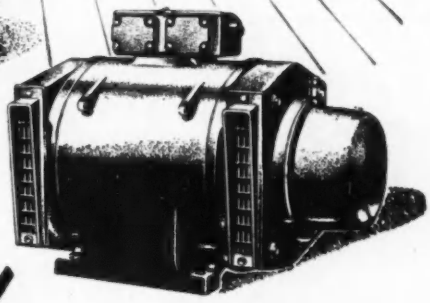
TRADE MARK LIMITED
CROWN YARD, CRICKLEWOOD, N.W.2
Telephone: GLADSTONE 4201

They bear the name

G.E.C.





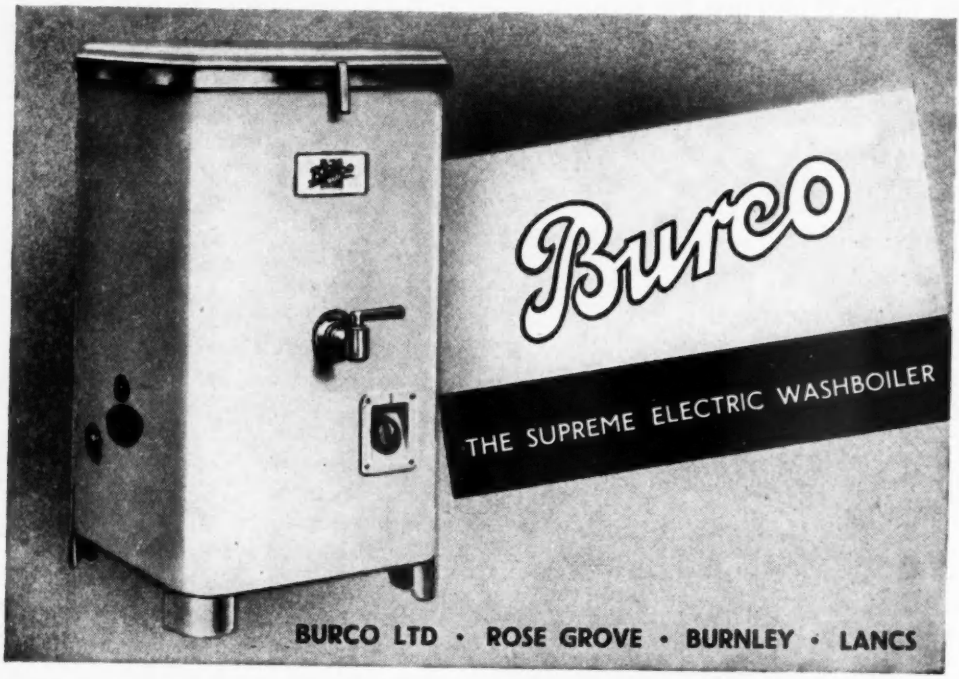


. . . and a name

for RELIABILITY

G.E.C. STANDARD INDUSTRIAL MOTORS

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2



ANNOUNCING

MODEL NO. N.1600

for SPEED INFORMATION and 3-WAY PROTECTION of CASH RECEIVED

A FOUR TOTAL RECEIPTING MACHINE

Providing 3 identical, non-carbon printed records of receipts on

1. The Customer's Account
2. The Receipt Posting Stub
3. The Locked-in Audit Record

National

ALL TOTALS UNDER LOCK & KEY

For details and demonstrations please write or phone
THE NATIONAL CASH REGISTER COMPANY LTD.
206 Marylebone Rd., London, N.W.1. Paddington 7070

For new and used machine tools . . . power presses . . . sheet metal working and woodworking machinery, etc. . . . **F. J. EDWARDS, LIMITED**, 359-61, *Euston Road, London, N.W.1. Tel: Euston 4681-3771. 'Grams: Bescotools Norwest London*

ELECTRICAL REMOTE CONTROL CO., LTD. *LAR 5435*
PROMPT DELIVERIES
of Relays, Timers and other Electrical Control Apparatus
13-15, EVANSTON AVE., LONDON, E.4

VARNISHED SLEEVINGS IN COTTON, SILK AND GLASS

INSULATING MATERIALS

LAMINATED BAKELITE TUBES AND FORMERS

W. H. GRIMMER
50, BOW LANE, CHEAPSIDE, LONDON, E.C.4.
CITY 1791/2 CABLES—CHARTIMER LONDON

NALDERS
INSTRUMENTS

B.S. FIRST GRADE

Typical N.C.S. Instruments, Round type Switchboard pattern, as illustrated, sizes from 3½ in. to 8 in. dia. Dial. *Also* Sector, Rectangular and Edgewise types.

1. FREQUENCY METER (Nalder-Lipman Pat.). Precision or Industrial types to B.S.89. Readings independent of voltage and temperature variations over wide limits, hence the instrument can be left continuously in circuit. No self-heating error. Low voltampere consumption.

2. OVERLOAD AMMETER. Indicating Ammeter with special overload characteristic, the scale being arranged to give normal full load rating at approximately 75% of the deflection. The remaining 25% indicates starting current values up to 5 or 6 times normal full load.

3. POWER FACTOR METER. "Ideal" Power Factor Meter to B.S. Specification: 360 deg. scale. Independent of current voltage frequency or temperature variation met with in commercial practice. Low voltampere consumption. Supplied for single phase and poly-phase, balanced or unbalanced loads.

The N C S TRADE MARK Guarantees efficiency

NALDER BROS. & THOMPSON LTD.
DALSTON LANE WORKS, LONDON, E.8

Telegrams·OCCLUDE, HACK, LONDON *Telephone*·CLISSOLD 2365 (3 *lines*)

—6½ tons of condensate per hour!

DEWRANCE-YARWAY IMPULSE STEAM TRAPS

Illustration shows a section of a battery of 1" Dewrance-Yarway Impulse Steam Traps in a large chemical factory.

Quick heating due to their ability to discharge continuously on heavy condensate loads and intermittently on light loads and with their minimum size and weight, these Traps are particularly suited for service in the process industries. Only one moving part—the Valve; internal parts can be renewed without removal of Trap from pipeline. Suitable for pressures up to 400 lb./sq. inch without change of Valve and seat.

Sizes ¼" to 2" inclusive.

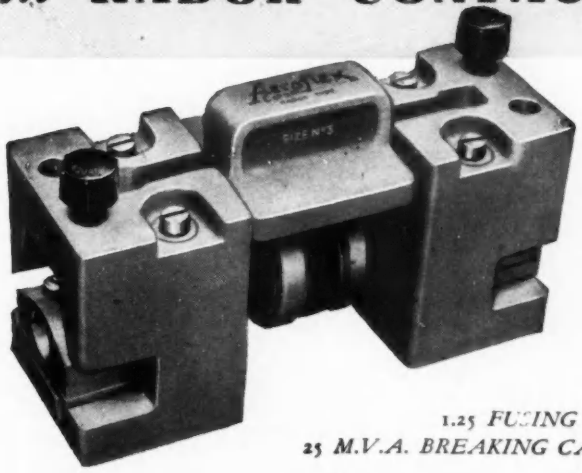
Steel with ends screwed B.S.P. Thd. or to A.P.I.

DEWRANCE & CO. LTD.

GREAT DOVER ST., LONDON, S.E.1. Tel. HOP. 1244 (10 lines). Works: LONDON, DUMBARTON & HILLINGTON.

Printed in England for the Proprietors, THE ELECTRICAL TIMES, LTD., by SUN PRINTERS, LTD., London and Watford, Herts., and published at Sardinia House, Sardinia Street, London, W.C.2. May 10, 1951.

Aeroflex Ceram HOPE'S PATENTS Fuses *in* RADOK CONTACTS



1.25 FUSING FACTOR
25 M.V.A. BREAKING CAPACITY

200 • 400 • 600 • 1000 AMPS, 440 V

Complying with BS 88 1947 Class P, Radok Fuse Units are fully shrouded and thus meet the requirements of the Factory Acts. They embody the new compact and economical Aeroflex Ceram Fuse Links which have multiple elements, and afford the valuable characteristics of rewireability and low fusing factor in sizes up to 1000 amps.

REWIREABLE ★

The contacts comprised in the Radok Fuse Unit afford perfect electrical continuity with a practically immeasurably low voltage drop, yet only firm finger pressure is necessary, the design causing a powerful leverage to be exerted against the fuse blades. Copies of list RU/1 are available on request.

PARMITER HOPE & SUGDEN LIMITED
FLUVENT ELECTRICAL WORKS, LONGSIGHT, MANCHESTER 12
London: 34 *Victoria Street, S.W.*1. *Glasgow:* 162 *Buchanan Street, C.*1

dm PH 40

Mazda helps to make it a Festival of Light

MAZDA LAMPS are being used extensively in the Festival of Britain, and Mazda Lighting Equipment is also employed for the exterior lighting of approximately one quarter of the South Bank Site.

The Mazda Lamps and many of the Mazda Fittings are standard, but in addition much special equipment has been designed to meet unusual requirements.

Among the dramatic features with which Mazda has been associated are :—

The Skylon, or ' Vertical Feature '
The Mural (by Feliks Topolski) by Hungerford Bridge
The huge formalised screen along Waterloo Road
The symbolic ' Minerals of the Island ' feature
The garden in front of the Agriculture (' Natural Scene ') Building
The Ceremonial Mast—Canada's gift to the Festival (a Douglas Fir tree flagstaff)

For Brilliant and Spectacular Lighting

Say Mazda!

THE BRITISH THOMSON-HOUSTON CO. LTD.,
Crown House, Aldwych, London, W.C.2.
(*Member of the A.E.I. Group of Companies*)

B T-H

M4340